FIRST AMERICAN SURGICAL ASSOCIATION NUMBER

Vol. LXXXIV AUGUST, 1926 No. 2

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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J. B. LIPPINCOTT COMPANY, PUBLISHERS

MONTREAL PHILADELPHIA LONDON

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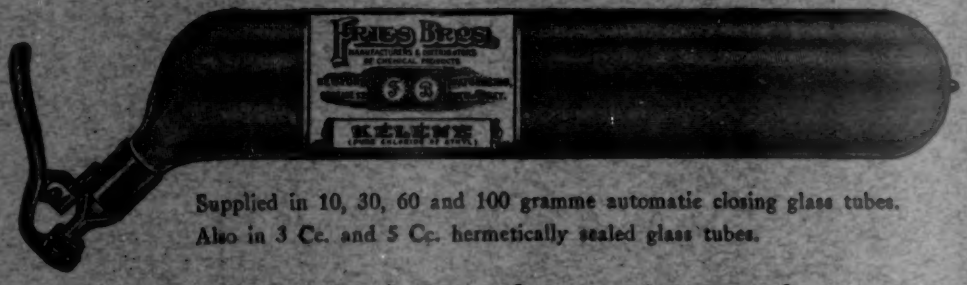

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ANNALS of SURGERY

VOL. LXXXIV AUGUST, 1926 No. 2

THE PSYCHOLOGY OF THE SICK MAN

PRESIDENTIAL ADDRESS, AMERICAN SURGICAL ASSOCIATION, MAY 24, 1926

BY JOHN H. GIBBON, M.D.

OF PHILADELPHIA, PA.

IN CHOOSING for my subject the Psychology of the Sick Man, I propose to avail myself of one of the privileges of the office and indulge in broad philosophical wanderings over the realm of medicine as some of my predecessors have done, and I think to advantage.

I should first like to offer as a proposition that the advancement of the art of surgery will not come with the invasion of new anatomic fields nor with the further perfection of technic, except in the field of anæsthesia, but will come with increased knowledge of the cause and prevention of disease, with the improvement in diagnostic methods, with the exercise of better surgical judgment and with a broader knowledge of general medicine. This may prove a poor prophesy, but you will agree that the sources from which I have indicated advancement might come, certainly represent fields in which we particularly need to work.

It is a trite statement that the more a surgeon knows of general medicine the wiser surgeon he is, but with our present-day methods of education and the arrangement of our interne services and apprenticeships, the foundation on which the young surgeon has to build, is too narrow. It would be far better for the young man if he could forget during this preparatory period that he is to become a surgeon and devote himself to the acquirement of as broad a knowledge of medicine as possible. It must be understood at the outset that I am looking on surgery as an art and the man who practices it as one upon whom his fellow-man can call in time of need and expect to find a practical man possessing not only knowledge but wisdom. Who of us if sick would choose as his physician a scientist? Who would not choose the man best versed in the art of medicine, one who utilizes all that science can give him and who is capable of applying his knowledge in a practical way and who has had a broad experience in the practice of his art? I would not be understood to decry scientific research since modern surgery owes to it its being, but the scientist is a poor physician largely because of his limited field of vision and experience.

It is of the psychology of the patient, however, that I want to speak at some length, as I believe it is a matter to which the average surgeon pays little

attention and this little subconsciously. It is not exactly a neglected subject; for instance, much of the good to be derived from Crile's "anoci-association" is due to the consideration given to the mental state of the patient. Every surgeon needs to consider the patient's attitude toward his ailment, and should be able to distinguish to a certain extent the imaginary from the real symptoms. He should know how to help the patient rid himself of those which are not real and also how to avoid inspiring or augmenting them.

The layman to-day likes to think he knows something about disease and its treatment and is very apt to think he is in a position to decide the type of treatment which his peculiar kind of malady requires. The man who is sick, or who thinks he is sick, is most susceptible to suggestion, is keen to put his own interpretation on a chance word, an expression of the face or a single laboratory finding; with the result that he is, at least mentally, either better or worse. Nothing is more impressionable than the mind of a sick man and it is the realization of this fact and the use of it to their own ends that has caused the quacks of all ages to prosper. It is to the exploitation of this human weakness that Christian Science, Osteopathy and Chiropracty owe their success.

Every practitioner of medicine should understand something about psychology, about hysteria and about psychotherapy. He should know what havoc imagination can work, what feeds it and how it can be suppressed. Many a physician or surgeon in taking a history by suggestive questioning, by explaining to the patient, under the idea that he is being perfectly frank and honest, the result of certain laboratory studies and by giving in detail the necessary treatment, may very easily be adding to his patient's suffering. Many of our modern methods of study have this effect. The various commercial societies and companies which have sprung up all over the country urging the healthy as well as the sick, to subject themselves, often through the medium of the mail, to a thorough examination of all their functions at stated intervals, and then put the results into the patient's own hands are doing much more harm than good. Such examinations by a conscientious and capable physician who can also study the mental attitude of the patient would be an entirely different thing and produce only good results. I am always sorry for the poor patient who turns up with his X-ray plates, his history and the reports from the various laboratories in his hands and then tries to make his symptoms correspond to them. When one tries to reassure him he comes back with, "Well, how do you explain the shape and position of my colon in these plates?" or "But the röntgenologist says that I have chronic appendicitis," or "How can I get rid of those streptococci in my bile? You ought to see my bile." How much better off and how much easier to cure is the poor human derelict who comes into the ward not knowing a thing about himself, or the intelligent man who puts himself confidently in the hands of his physician and does not want to know all about the "findings." Under the mistaken idea of honesty many of our specialists are making neurasthenics of their patients and I sometimes think that behind a good

deal of their frankness is the desire to impress the patient with their profound knowledge and thoroughness. Pope must have had in mind the "Malade-Imaginaire" when he wrote:

> "A little learning is a dangerous thing;
> Drink deep, or taste not the Pierian Spring;
> There shallow draughts intoxicate the brain,
> And drinking largely sobers us again."

and Donne, I am sure, was thinking of the neurasthenic when he said, "Who are a little wise, the best fools be."

Much of the sex hygiene taught in schools is presented in such a way as to do enough harm in certain cases to offset all the good it does in others. I can sympathize with the poor mother who wrote as follows: "Dear Teacher, Don't learn Mary no more about her insides. It's rude and it don't do no good." It is just as important for a surgeon to realize the possibilities of suggestion as it is for any other practitioner of medicine.

That well-trained physician and neurologist of Guy's Hospital, Arthur F. Hurst says: "I believe that the most common source of suggestion of hysterical symptoms is some organic disease or injury, the symptoms resulting from which are perpetuated or aggravated by autosuggestion, sometimes with the help of the unconscious hetero-suggestion, produced by the questions and the treatment recommended by the physician if he does not recognize the true nature of the condition. When thus produced, hysterical symptoms always simulate organic symptoms which preceded them more or less closely. In many cases when a certain degree of improvement has occurred in the original organic condition, a mixture of an organic basis with a superimposed hysterical element is present. I believe that this is a much more common event than is generally supposed, and that every organic incapacity tends to suggest a greater incapacity."

A good surgeon must be a good diagnostician and should not operate on someone else's diagnosis. If he is not capable of diagnosing the diseases he treats, he should not treat them.

In the training of the student and young surgeon, too much stress is laid on surgical technic and too little on the pathology and natural history of disease and on diagnosis. Diagnosis by exclusion is an excellent plan, but we surgeons too often make this a physical exclusion. In other words, in order to make a diagnosis of a neurosis, it should not be necessary to remove first the appendix, then the gall-bladder and then the colon. This method of reaching a diagnosis, which neurologists like to think of as being the surgical method, not only is of no value but by the time the correct diagnosis is made the patient is often beyond hope or he becomes one of the much lauded cures of Christian Science or Osteopathy. Just to illustrate that I am not indulging in exaggeration, I should like to refer to the case of a nervous, but fat and healthy-looking young man, who for a number of years had been in the hands of different internists who treated him largely for mucous colitis. He was sent by his physician, who was at the end of his

string, to a surgeon with a diagnosis of chronic appendicitis. This was in 1919. There was little evidence of appendicitis but there was present an incomplete hernia. This was operated upon and the appendix removed through the sac. During the next two and a half years this patient continued to complain of vague and indefinite upper abdominal symptoms and was examined and treated by a great many physicians. The surgeon who operated upon him in the first instance doubted the existence of a lesion, but the patient had been to a large sanatarium where his X-ray plates were shown and explained to him as indicating undoubted disease of the gall-bladder, and he was told that operation was imperative. He was then carefully studied by a very capable gastro-enterologist who also advised operation in spite of his undoubted neurotic symptoms. His upper abdomen was opened and the gall-bladder and ducts as well as the stomach and duodenum found to be absolutely normal. These negative findings instead of being a comfort to the patient, only disturbed him the more and he sought advice of another surgeon eighteen months later. This surgeon operated and found his gall-bladder and duodenum adherent, but no other lesion, and removed his gall-bladder. This was in May, 1923. He was "cured" for a brief season, but his symptoms returned and later another surgeon operated upon him for "adhesions" which were separated and the colon fixed between the duodenum and the liver. This did not relieve the situation, however, and within a year, on the advice of a distinguished internist, who thought that he might have a duodenal ulcer, in spite of the fact that he had had three previous operations by experienced surgeons, he was again operated upon. No ulcer was found but the distal portion of the stomach removed. At the present time he is being treated by a specialist for infection of the gums. Every one of the four surgeons who operated upon this man, was a Fellow of this Association, myself, I am ashamed to say, one of them. This is not an unusual story, but I do not think we learn the lesson which these cases teach. We study our physical results, we take pains to eliminate or lessen the operative risks, but would it not be well to go into the psychologic and gastro-enterologic clinics occasionally and see some of the results of our mistakes in diagnosis and treatment? Would it not be well to have the neurologist see some of these cases before rather than after operation? Oh, I am sure that I am not wide of the mark in insisting that surgical results can be improved by a familiarity on the part of the surgeon with the various neuroses, psychoses and hysterias. I realize that many useless and harmless operations such as the removal of the colon are being done on the insane at the behest of a few unbalanced psychiatrists with the idea of actually curing the mental disease. No insane patient is ever cured of insanity by a surgical operation done on his abdominal or on her pelvic viscera and the neurotic and hysterical patient is invariably made worse ultimately by such operations, which very rightly bring discredit on surgery. It, of course, goes without saying that the insane patient and the neurasthenic, who has a real surgical lesion, should have exactly the same treatment which is given a mentally normal person.

In every contact with the patient the surgeon must constantly bear in mind the effect his words and actions may have. Internes and nurses need to have this strongly impressed on them, and here example is better than precept. A perfectly normal woman was recently troubled, upset and disturbed after a colon resection for cancer by her physician who said, "Now it is all out and if you don't get an obstruction, you will be all right." Of course, with every subsequent "gas pain" she thought that the obstruction had arrived. A surgeon should inspire confidence, assurance and faith, and must be prepared to justify them with a sympathetic and conscientious exhibition of ability. A visit made to a patient after an operation which does not leave him cheered, comforted and more hopeful, had better never been made. It should always be realized that an indiscreet word, an anxious look or a lugubrious manner will leave the patient depressed, worried and full of fear. In the practice of surgery wisdom is as necessary as knowledge and not so easily acquired. "Knowledge comes but wisdom lingers."

> "Knowledge is proud that he has learned so much;
> Wisdom is humble that he knows no more."

Ian Hay, in a recent address to the students of Guy's Hospital, talked on the "Human Touch," and said among other good things, "Tell the patient something that will keep his imagination from soaring into the regions of unhealthy speculation." I would only add that we should avoid saying or doing anything that would turn the mind into these unpleasant channels. We surgeons every day have to tell poor, suffering, nervous humans unpleasant and disturbing facts, but let us tell them as we would have them told to us. Lying is not necessary and is a poor policy, if for no other reason than that it sooner or later is discovered and destroys confidence. No rule can be laid down, but the patient's mental attitude and the effect upon it by what is said, must be considered.

During convalescence coöperation on the part of the patient is most helpful and sometimes an absolutely essential element in restoring health and function. Cheering friends tell our abdominal cases that they will not "get over the effects of the operation for a year" and some of them will try their best to carry out the program. Tell a patient after a fracture of the leg that he will be lame for six months, and whether he needs to or not, he will limp for the allotted time. Limps in the absence of shortening or fixation are nearly all hysterical and can be readily overcome.

Not only should the surgeon know something of the neuroses, but he should be able to recognize the various manifestations of hysteria and realize their close resemblance to the symptoms of real surgical lesions. We have all known patients to undergo repeated operations for hysterical vomiting and for hysterical intestinal obstruction and then to be disappointed because further operations were refused.

In the field of traumatic and industrial surgery, something more is required than a knowledge of surgery. The surgeon in this field must be able to distinguish the real sufferer, the hysterical sufferer and the malingerer, and

the last is the most infrequent and the second much more common than is generally believed. Even in many cases involving compensation or litigation the apparent malingerer is not a malingerer at all, but suffering from hysteria the result of suggestion at the hands of friends, of fellow-workers, of his legal adviser and of partisan medical experts. This fact is pretty generally known, but do we realize how often it applies to cases in which there is no question of litigation? We must get over the idea that hysteria will always produce the physical stigmata of Charcot. Babinski and others have shown the fallacy of such an idea and that a perfectly normal person can suffer from hysteria. We surgeons can, in our own experience, amply illustrate this fact. The hysterical incapacities after operation and injury are every day occurrences, and although we may not designate them as hysterical, we prevent and cure them by suggestion and persuasion, and in doing so we are practicing psycotherapy, although we may not realize it.

I shall always feel indebted to Sir William Osler for suggesting a visit during the War to a neuropathic hospital in charge of Colonel Hurst, for here I learned in one morning a great deal about hysterical spastic palsy, which has proved of great value since. There are hundreds of men, women and children wearing apparatus or submitting themselves to repeated operations for this condition, who could be easily cured by suggestion. These are the patients who largely represent the cures accomplished at Lourdes, at Ste. Anne de Beaupre and at other shrines and by the bone-setters and the Christian Scientists. That these poor people get into this apparently hopeless condition is due largely to the fact that the nature of their affliction is never properly diagnosed or because we do not know how to prevent or cure it. I saw many cases of perfectly honest British "Tommies" who had suffered for months, and some for years, from these palsies for which some of them had been discharged from the army as incurable, cured in ten minutes by psychotherapy. A good example is that of a sergeant who had had a "through-and-through" wound of the forearm a number of months previously and who since his arm was taken off the splint had held his fingers tightly flexed on the palm until the growing nails had made ulcers. This man in five minutes was completely extending his fingers, together and individually, much to his own astonishment and joy. Another case in civil life which illustrates very well what I want to say, was that of a young man who was sent to the Jefferson Hospital from one of the towns in Northern Pennsylvania. He had had a fracture of the clavicle which a surgeon had wired and following the operation the patient had never been able to abduct the arm more than a few inches from the chest wall. He was supposed to have an ankylosis of the shoulder and the X-ray plates were thought to show certain changes in the bones and joint which would account for the disability. As massage, electricity and exercise had accomplished nothing, after months of use, operation was advised. From the general muscular rigidity whenever the patient attempted abduction and from the fact that when this was overcome by persuasion, certain movements could be easily carried out, a diagnosis of

hysterical spastic palsy was made, and in ten minutes this boy was carrying the arm up in full extension over his head. Massage, electricity, apparatus, operation all have their place, but are harmful in this condition since they only prolong it, and because it can be quickly cured by psychotherapy.

An important point is that patients should not be allowed to get into this condition and it is easily prevented. In this connection I would advise all young surgeons to read Colonel Hurst's article in the Osler Memorial Volume on "What the War Has Taught us About Hysteria."

One who doubts the effect of mind over matter should read Klauder's paper (*J. A. M. A.*, November 28, 1925) on the "Cutaneous Neuroses," in which he shows among other interesting tests, that by suggestion blisters can be made with postage stamps.

The diagnostic habit needs to be cultivated by the surgeon and the young man needs to be taught that there is a something more in the art of surgery than operative skill and technic. The link between surgery and psychology is too important to be neglected. Lawrence Sterne said of his teachers at Cambridge that they "were men of reading who thought that 'wisdom can speak in no other language than Latin and Greek,'" and I sometimes think there are too many practitioners of medicine who, in making a diagnosis, depend too much on the laboratory findings and fail to recognize many perfectly patent signs and symptoms which one experienced in the art sees at a glance. The wise practitioner knows his Latin and Greek of the laboratories and uses them, but he does not start or stop with them.

> "Canst thou not minister to a mind diseas'd,
> Pluck from the memory a rooted sorrow,
> Raze out the written troubles of the brain,
> And with some sweet oblivious antidote
> Cleanse the stuff'd bosom of that perilous stuff
> Which weighs upon the heart?"

THE "REHABILITATION" OF THE SURGICAL PATIENT THROUGH BIOCHEMICAL METHODS, WITH SPECIAL REFERENCE TO DIABETES*

By William J. Mayo, M.D.
of Rochester, Minn.

In 1850, Jakob Moleschatte, Professor of Physiology, Anatomy and Anthropology in the University of Heidelberg, said "Man is composed of the food he eats." Poor Moleschatte: his statement was regarded as blasphemous, and he was expelled from his positions, and from the university. In the seventy-five years that have elapsed, the truth of his deduction has been recognized, and we can congratulate ourselves that intolerance and religious bigotry have abated sufficiently to permit discussion of the science of nutrition as applied to man.

Fundamentally, "rehabilitation" concerns preservation of the body; biochemically it is directly related to the metabolism of foods. The newer studies on nutrition have given the key to many problems concerning general physical conditions which heretofore have been unsurmountable. Studies of the blood and of the blood plasma as well as of the tissues of the body have usually made it possible to restore resistance and overcome toxæmia pre-operatively. There has been much confusion in the nomenclature with regard to toxic conditions; the types of toxæmia often being named as though they were caused by the vital organ which shows the final lethal change, for example bronchopneumonia or terminal nephritis, rather than the fundamental causes which actually bring about dissolution.

The rehabilitation of surgical patients through biochemical methods before operation is perhaps the most important consideration in modern surgery. The object is not only to improve the patient's general condition, but to overcome the results of disturbed function, the deficiency of vital substances, and the formation or retention of poisonous excretory products. Unless the function of vital organs can be restored nearly to normal in serious diseases that do not immediately threaten life, the risk of surgical operation may be so great as to outweigh the advantages to be obtained. Walters states facts as follows:

"Life depends on the oxidation of carbon. Carbohydrates are used as glucose, stored as glycogen in the liver, and the excess deposited in the body as fat. Unfortunately, fats cannot, to any considerable extent be reconverted into glucose; furthermore, sufficient glucose must be available to maintain combustion of fats; otherwise the higher fatty acids will not undergo complete combustion, and acetone and diacetic acid will appear in the tissues and cause toxæmia, which in the more severe grades may terminate in coma, as in cases of diabetes.

* Read before the American Surgical Association, May 24, 1926.

"On the contrary, proteins can, to a considerable extent, be converted into glucose, but they contain nitrogen. Under stress, as in cases of starvation or hepatic disease, sufficient glucose is not available; the protein tissues of the body are broken down for the purpose of producing the necessary glucose, and the resultant excess nitrogen must be excreted in the urine. The kidneys may be unable to excrete this excess of nitrogen, which then accumulates in the blood, for the most part as urea, and a small percentage as creatinin, producing toxæmia of which uræmia is a manifestation."

Diabetes presents two problems to the surgeon: (1) the cure and prevention of diseases requiring surgical treatment, which arise directly or indirectly from diabetes, and (2) safety in the performance of necessary operations on patients with diabetes for lesions not associated with the diabetes.

Long ago Pavy pointed out that the mere reduction of the amount of sugar in the urine was not of itself a sufficient safeguard for patients obliged to undergo surgical procedures, and that restriction of carbohydrates in the diet should not be carried to a point at which the patient's general health and strength suffered. Billings and Allen have still further illuminated the treatment of diabetes by demonstrating that if the carbohydrates in the diet are reduced too greatly, the nutrition being maintained by proteins and fats, diabetic coma and other manifestations of severe diabetes are likely to ensue, but that if the patient is treated by the so-called starvation method, the fats and proteins being reduced as well as carbohydrates, this danger will be greatly lessened.

In 1915, Berkman demonstrated that the surgical patient with diabetes who was too thoroughly prepared for operation by overreduction of carbohydrates, did not withstand operation as well as the underprepared patient. He advised maintaining the patient's nutrition by a mixed diet. This was practiced in the clinic with the result that the former high mortality rate following operations on patients with diabetes was greatly reduced.

Before insulin became available, Wilder and Adams, by careful pre-operative and post-operative dietetic treatment of patients with diabetes, were able to reduce the mortality rate following operations in selected cases practically to that in cases without diabetes. In such cases at least 100 gm. of carbohydrates is now given for five days before operation and not less than 75 gm. on the average each day after operation, with sufficient insulin to maintain tolerance. Recently Wilder and Adams reported 141 unselected cases in which major operations were performed for general surgical diseases, complicated by diabetes, with but four deaths, a record which would be excellent in cases uncomplicated by diabetes. With the aid of insulin, operations of expedience may be performed on patients with severe diabetes on whom in the past only operations of necessity would have been undertaken.

At the finish of a recent Marathon race the condition of the runners was noted with special attention to the state of the blood. The runners who finished the race, for instance, Nurmi, showed a normal content of blood sugar, whereas the runners who dropped exhausted by the way, often in a shock-like

condition, sometimes resembling mild grades of coma, showed a low content of blood sugar. By eating sugar and resting in the horizontal position they quickly regained strength. Later some of these runners were given sweet chocolate to eat as they ran, and these maintained a higher degree of endurance. The efficacy of sugar in maintaining endurance has been demonstrated also by the Arabs, who eat dates on long marches.

One of the greatest commanding officers of the Civil War was Stonewall Jackson, who, with a small army, was able to march his troops so rapidly in the region across the Potomac from Washington that they were called " foot cavalry." He accomplished this by marching the soldiers several hours, then having them lie flat and relax for a few minutes. By resting in this manner the lactic acid, which accumulates in the muscles during action and produces fatigue, is in large part restored to glucose, as A. V. Hill and Meyerhof have recently shown. The soldiers were then given whatever food the sutler wagons afforded, usually carbohydrates, with fluids; this quickly supplied the necessary sugar, and they were again marched a shorter distance with another period of rest and similar restoration. By repeating this process at intervals, Jackson was able to move his ragged, barefoot men over bad roads as much as forty miles in twenty-four hours and have them in fighting condition. One might say that Jackson prolonged the Civil War two years; he was able to keep Washington in fear of capture, forcing McDowell's army to remain on guard, instead of aiding the offensive on Richmond. It was believed that if Washington were taken by the Confederates, England and other foreign countries might recognize the belligerents of the South.

The test for the amount of sugar in the urine as a guide to the severity of diabetes has largely given way to a test for sugar in the blood. Sugar in the blood is a threshold substance. The threshold varies greatly in height in different persons. When the sugar exceeds a certain level, so to speak, it flows over the top and appears in the urine. A person with a low sugar threshold may have glycosuria after eating an unusual amount of carbohydrates, such as candy, and yet not become afflicted with diabetes. Another person with high sugar threshold may have no sugar in the urine, but an excess in the blood, which in cases of slight infection may cause serious disturbances. Even study of the sugar in the blood may fail to tell the whole story. Sugar is stored in the liver and other tissues as glycogen, which is merely a condensation product of glucose.

Experience in the clinic would indicate that certain patients with a normal amount of sugar in the blood may in times of stress be unable to store sufficient glycogen in the liver, as is illustrated by the following case:

The patient, a woman, aged forty-four, had had malignant disease of both ovaries and tubes, for which abdominal hysterectomy was performed. She left the operating table in good condition, but six hours later coma developed, no clue to which had been given in the history or preliminary physical examination.

Examination of the blood showed a very low sugar content and acidosis.

An intravenous injection of 10 per cent., glucose solution with bicarbonate of soda and a moderate amount of insulin was given. The patient regained consciousness in a few moments. The injections were continued for three days, and convalescence was rapid. The patient left the hospital in due time, and has remained well.

Wilder reports two cases of carcinoma of the liver in which hypoglycemia occurred post-operatively with accompanying shock-like symptoms which were relieved by intravenous injections of glucose. Patients with hyperthyroidism are susceptible to hypoglycemia, particularly if insulin is used, probably an exhaustion of the blood sugar from overwork caused by the high metabolic rate.

The study of the comatose conditions which accompany diabetes is most interesting. The cause of the coma lies in the metabolism of the fats. The metabolism of fats and their combustion, producing heat, energy for vegetative functions, and notably water, take place very slowly. This explains the state of certain animals during hibernation, when their temperature drops to about half that normal to warm-blooded animals, and there is a general abeyance of function, while life at a low level is sustained by the slow oxidation of the stored-up fat. Unfortunately, without the addition of glucose, fat cannot be completely burned. When there is a lack of available sugar, fat which can be converted into sugar if at all, does not exceed 10 per cent.

The molecule in animal or vegetable fat always has an even number of atoms, which are oxidized in the body two at a time. When the carbon atoms are burned down, say to four, if sugar is not available, diacetic acid or acetone is formed, and coma may result. If the molecule of fat contained an uneven number of carbon atoms which burned two at a time, the low point would be five, at which valeric acid would result, or three, at which lactic acid would result, both harmless. An attempt to produce a fat with an uneven molecular composition has been successful in a chemical sense, but unsuccessful from the physical standpoint, in that the body seems to be unable to metabolize such artificial fats. When glucose is not obtainable from ingested carbohydrates or proteins, and the stored glycogen in the liver is exhausted, glucose can only be obtained by breaking down deposit or tissue proteins. About 58 per cent. of these proteins can be converted into glucose, but the process liberates into the blood stream an excess of nitrogen, recognized as urea, and disorders result, not only from acetone, but from the rising tide of blood urea. Diabetic coma, formerly so greatly feared by physician and surgeon alike, yields readily, almost specifically, to insulin. A properly regulated diet, with judicious employment of insulin and glucose solution renders the patient with diabetes a good surgical risk in the majority of cases. But care is always necessary, since with improper handling the mildest forms of diabetes still may become a grave source of danger.

It is interesting, as related to the pancreatic theory of diabetes, that when children have died in diabetic coma, ordinary methods of necropsy often disclose no changes either in the pancreas or in the islands of Langerhans. On the other hand, Allen states that in such cases necropsy made immediately

after death, while the body is warm, does disclose changes in the islands of Langerhans. Pancreatic changes are usually manifest in older persons who, generally speaking, are over-nourished, not always obese, but nearly always large eaters. Perhaps the demand on the pancreas beyond the nutritional necessity causes the body insulin to wear out and result in functional deficiency of the islands of Langerhans.

If pancreatitis accompanies infection of the gall-bladder, it does not take the form of atrophy of the pancreas and of the islands of Langerhans, rather characteristic of diabetes. On the contrary, the changes in the pancreas, as a result of biliary infections are usually of the type called chronic pancreatitis, enlargement and thickening. Removal of the infected gall-bladder in the presence of chronic pancreatitis may be followed by improvement in the diabetes, but such a favorable result is not obtained with sufficient frequency to justify operating, in the hope of curing the diabetes, on a gall-bladder suspected of being diseased. At least it is a comfort to know that diabetes is not necessarily a contraindication to an operation for definite disease of the gall-bladder.

Someone has facetiously called diabetes a foot and mouth disease. Food in the form of carbohydrates in excess enters the mouth; in the susceptible person the insulin machinery is exhausted with the result so frequently seen, that the patient dies from gangrene of the foot. It has been a common experience in cases of diabetes, that when there is arteriosclerotic gangrene of the lower extremities, which necessitates amputation of part of the limb, great improvement in the general condition of the patient with a reduction in the symptoms of diabetes may take place after the amputation. One of the necessary steps in the treatment of diabetes is to eradicate all sources of focal infection which can be removed safely. Joslin is wise indeed in his advice to amputate the leg above the knee in cases of the acute, florid type of diabetic gangrene when there is discoloration of the entire foot and ankle without a line of demarcation, and high temperature. This is a condition which in the past has so frequently resulted in death, and in which early amputation will save life. Joslin emphasizes the fact that care of the feet, next to a proper dietetic regimen, is the most important measure in the treatment of diabetes. A patient with diabetes should wear several pairs of shoes in succession. The trimming of corns and calluses should be regarded as a serious operation, to be done under antiseptic precautions, in the morning rather than at night, so that all swelling and œdema in the muscles about the foot from the day's usage will have disappeared.

Carbuncles and boils on the back of the neck are most common in men, especially those with diabetes, and usually in those who have the back of the neck shaved. It is quite probable that the present fashion, no doubt a good one, of women cutting their hair, particularly shaving the back of the neck may reduce this masculine predominance. Clipping the hair on the neck should be safer for the patient with diabetes than shaving it.

The use of the actual cautery to destroy carbuncles, advised by Charles

H. Mayo in 1901, is extraordinarily efficacious. It has been used in the clinic successfully for many years for all forms of carbuncles, both in the patient with diabetes and the patient without diabetes. The dark-red heat of the soldering iron is best, and with it the entire area of the carbuncle is converted into an eschar. The eschar is left without a dressing, and the dry treatment for burns is applied. If necessary, an electric fan is used to keep the surface dry, and dry powdered boric acid may be rubbed in to absorb moisture. When the slough begins to separate, the usual applications of antispetic wet dressings are made. Astonishing results are seen in cases of severe carbuncle. The patient suffering with pain and high temperature, within a few hours after the cautery treatment is quite comfortable and up and about with normal temperature.

In closing it may be said that progress in the surgical treatment of patients with diabetes has come, not so much through improvement in technic, as in the pre-operative care of the patient, in the attention to such small matters as the care of the feet, the prevention of skin infections, and in the intelligent use of diet, insulin and glucose.

FINAL RESULTS IN THE SURGERY OF MALIGNANT DISEASE*

STUDY OF A TWELVE YEAR FOLLOW-UP

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Five hundred seventy-three cases of malignant disease were observed in the First (Cornell) Surgical Service during the period February, 1913, to January 1, 1925.†

An attempt was made to follow every case for at least ten years; but rapid changes of residence, departure of patients from the city or country, etc., often nullified our work. We were materially aided by the efficient and devoted coöperation of the Social Service Department in charge of Miss Josephi.

No sadder report of the disheartening status of cancer surgery has come to our attention. It is, however, inevitable, dealing only with facts (Table I).

Table I

Operative Cases

(All operations whether radical, palliative or exploratory)

Number of operations	437
Number of deaths	308
Number of known living	73
Unknown	56

No Operations

Number of cases	136
Number of deaths	92
Number of known living	12
Unknown	32

Table I (a)

Grouped as to Sex and Age

Male 200 (of this number 53 were stomach, 33 intestines, 10 epithelioma of lip).

Female 237 (of this number 78 were breast, 38 uterus, 27 intestines, 18 stomach).

(Note.—Females predominate. There are fewer beds for females available in the New York Hospital.)

Carcinoma of stomach in females one-third that in males, due probably to the above reason.

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* Read before the American Surgical Association, May 26, 1926.

† The routine follow-up on these cases was closed in October, 1925; but we are constantly receiving additional data through our follow-up service and any information has been added up to date.

Age

Ages	Number	Carcinoma	Sarcoma	Endothelioma	Hypernephroma and teratoma
Below 10	4	1*	3	0	0
10–20	7	3	3	1	0
20–30	37	16	14	6	0
30–40	75	56	18	0	1
40–50	127	111	11	4	2
50–60	116	110	3	3	0
60–70	56	54	1	1	0
70–80	12	12	0	0	0
80–90	3	2	1	0	0
	437	365	54	15	3

* Case of neurocytoma of kidney.

79 per cent. of carcinoma cases over 40—60 per cent. from 40 to 60 years.

70 per cent. of sarcoma cases under 40—80 per cent. from 20 to 50 years.

A simplified classification makes large groups of the various pathological conditions, *e.g.*, carcinoma and epithelioma a single group; all forms of sarcoma another one.

Table II is the keynote of this paper. Of the 437 operative cases who came under our observation, only 64 are living to-day without recurrence and only 13 have survived the artificial and questionable time limit of five years.

To those unfamiliar with the cancer question these results seem to reflect severely on the practice of surgery and the ability of the operators. The great bulk of the work was done by three members of this association, Gibson, Lee and Hitzrot, whose work may be taken as a fair cross-section of the surgical practice of this country.

Before adopting too harsh conclusions, it should be remembered that this paper is practically an unique contribution to the subject. While the total number is not impressive, I find no similar study of the *total material* of twelve consecutive years and on which a vast amount of personal effort, time and money have been spent in the pursuit of results. Similar research emanating from other institutions would doubtless furnish surprises.

Table III shows only a few still alive with recurrence. There were six cancers of the breast recurring after five years.

TABLE II

Living Cases—No Recurrence

(Divided According to Number of Years Post-operative)

Ten Years

Carcinoma (2)
Tongue
Breast
Sarcoma (2)
Bone
Gum

Eight Years

Carcinoma (1)
Breast
Sarcoma (2)
Intestines
Bone

TABLE II—*Continued*

Living Cases—No Recurrence

(Divided According to Number of Years Post-operative)

Seven Years
- Carcinoma (2)
  - Intestines
  - Uterus

Six Years
- Carcinoma (2)
  - Breast
  - Face
- Sarcoma (1)
  - Bone
- Endothelioma (1)
  - Lymph-nodes

Five Years
- Carcinoma (7)
  - Appendix (2)
  - Breast
  - Face
  - Lip (2)
  - Scrotum
- Sarcoma (5)
  - Bone
  - Lymph-nodes
  - Neck
  - Stomach
  - Uterus

Four Years
- Carcinoma (7)
  - Appendix (2)
  - Breast (2)
  - Stomach
  - Thyroid
  - Uterus
- Sarcoma (1)
  - Bone
- Endothelioma (1)
  - Parotid

Three Years
- Carcinoma (6)
  - Breast
  - Intestines
  - Rectum
  - Stomach
  - Tubes and ovaries
- Sarcoma (2)
  - Bone
  - Forearm
- Endothelioma (2)
  - Ovary
  - Parotid

Two Years
- Carcinoma (7)
  - Breast (2)
  - Face
  - Kidney
  - Submaxillary gland
  - Uterus (2)
- Sarcoma (4)
  - Bone
  - Tendon sheath
  - Finger (2)
- Endothelioma (1)
  - Lymph-nodes

One Year or Less
- Carcinoma (6)
  - Breast (4)
  - Penis
  - Face
- Endothelioma (2)
  - Lymph-nodes
  - Neck

Total 64 cases

TABLE III

Living, But With Recurrence

Nine years
- Carcinoma
  - Breast (after 9 years carcinoma in opposite breast. Original site of operation all right)

Four Years
- Carcinoma
  - Breast (2)

TABLE III—*Continued*

Living, But With Recurrence

Three Years
Carcinoma
Breast
Stomach

Two Years
Carcinoma
Uterus
Sarcoma
Intestines

One Year or Less
Carcinoma
Intestines
Stomach

Total number of cases—9

Table IV shows the sarcomata as more benign than the carcinoma.

TABLE IV

Of the 64 living cases with no recurrence:
58 per cent. of these sarcoma are living 5 years or more post-operative.
36 per cent. of these carcinoma are living 5 years or more post-operative.
16 per cent. of these endothelioma are living 5 years or more post-operative.

Table V gives the relative freedom from recurrence of the several types. The frightful results in cancer of the intestines and stomach are impressive.

TABLE V

Statistics Based on Known Results Only	%
Carcinoma of face, per cent. living, no recurrence	80
Endothelioma of lymph-nodes	75
Carcinoma of appendix	66
Sarcoma of bones	53
Carcinoma of lip	40
Carcinoma of breast	18
Carcinoma of uterus	15
Carcinoma of tongue	14
Carcinoma of intestines	4
Carcinoma of stomach	3

The 100 per cent. mortality of the conditions described in Table VI is readily understood, although the 100 per cent. mortality in cancer of the gall-bladder may not be generally appreciated. Our fifteen cases, irrespective of condition or treatment, were dead within six months.

TABLE VI

100 per cent. mortality—
Gall-bladder
Œsophagus
Larynx
Liver
Pancreas
Prostate
Peritoneum and omentum

Table VII is based on the known deaths only. The mortality would doubtless be higher if the "unknown" were included.

TABLE VII

Known Mortality

Type	Number of operations	Deaths	Per cent.
Hypernephroma and teratoma	4	4	100
Carcinoma	323	274	84
Sarcoma	47	29	61
Endothelioma	8	1	12

A summary of malignant tumors is appended.

This study is limited to ward cases. In private patients we cannot pursue the same rigid tracking down of patients taking every possible means of obtaining information. It seems unwise therefore to include in the same group, cases conforming to different standards. Our private patients, particularly the breasts, show better results.

This investigation aims to give a broad survey of the mass results of malignant disease. Therefore we have omitted the dissection of the statistical evidence into the finer distinctions as recommended by some investigators because of the confusing element of personal judgment of conditions. We do not think it wise to rate the unknown as necessarily dead, as quite a number of these fall in the category of obviously better results.

No branch of surgery shows such statistical fallacies as the results of cancer. Probably the great bulk of the cases operated radically have existing metastases which lie dormant. For example, case 223,299, living seven years after resection of the colon, had also diffuse metastases of the lymph-nodes as proven by microscopical examination. A private patient with suture of a free perforation of a gastric cancer with extensive metastases (microscopic examination) is alive two and one-half years after operation. Case 240,695 came in with acute obstruction from a sarcoma of the jejunum with extensive infiltration of the mesentery. A resection of the gut and an end-to-end anastomosis was done, although the section went through the invaded area. Patient lived three years and seven months after operation.

A private patient with bilateral carcinoma of the ovaries is now living seven years after a second operation, nine years after the first operation, although at the last operation there were diffuse metastases throughout the abdomen. None of these cases just quoted received any form of post-operative treatment.

In general terms I think it may be said that the results of cancer are bad in proportion to the accuracy of the microscopical examinations, and at the New York Hospital we are fortunate in having so recognized an authority as Doctor Elser, Director of Laboratories, and we also enjoy the coöperation of Professor Ewing, who has often been appealed to for important advice and decisions.

Our ward patients present a very sad picture of having consulted many physicians before any intelligent attempt was made to determine their con-

ditions. Particularly sad are the victims of the gastro-intestinal tract; pills, powders, diet, etc., for indigestion without any kind of examination. The cancer of the colon is treated for constipation until acute obstruction occurs; those with bleeding are given pile remedies (?) without any kind of an examination.

Our histories contain a specific query of what happened to the patient the first time he consulted a doctor. With rare exception were they given advice or examination of any value.

The value of the palliative operation. For the laity an operation is an operation. If we yield to the importunities of relatives and perform a gastro-enterostomy, gastrostomy or colostomy as an act of mercy, surgery is credited with a failure to cure.

What is the outlook for improvement, early diagnosis and treatment? I think the public will solve that question rather than the profession. There was much the same problem in tuberculosis and the decided improvement began when the public, including the poorer and ignorant, learned for themselves what the problem was and how to handle it.

We have been living in a fool's paradise of fallacious statistics. All the older figures should be ruthlessly junked and so-called radical operations should only be performed after the most painstaking search for metastases is exhausted. Outside of visible and palpable manifestations we have nothing but X-ray examinations for skeletal or intrathoracic deposits and these demonstrable only after attaining some size. A really comprehensive X-ray examination means examination of practically the whole body and infinite labor and expense.

Our investigation for possible metastases is shown in the two tables. While of late we are making a creditable showing, *e.g.*, 93 per cent. examination in breast cases, it is a most mortifying lesson of ours to show less in realizing the importance of this development. On the whole, the positive evidence obtained has not been very great; but Doctor Wade of our House Staff will later publish a more detailed analysis of the material which we trust will be helpful.

TABLE VIII

Summary of X-ray Examinations for Metastases in Cases of Carcinoma Admitted to the First Surgical Division of the New York Hospital 1914 to 1925

		Cases
Group I.	Carcinoma of gall-bladder, and ducts, liver œsophagus, pancreas and stomach	220
Group II.	Carcinoma of intestine, mesentery, omentum, peritoneum, rectum and peritoneal glands	82
Group III.	Carcinoma of breast	86
Group IV.	Carcinoma of female reproductive organs	65
Group V.	Carcinoma of other organs	60

Approximately 75 patients have received by our direction some form of radiotherapy, either post-operatively or when radical operation could not be

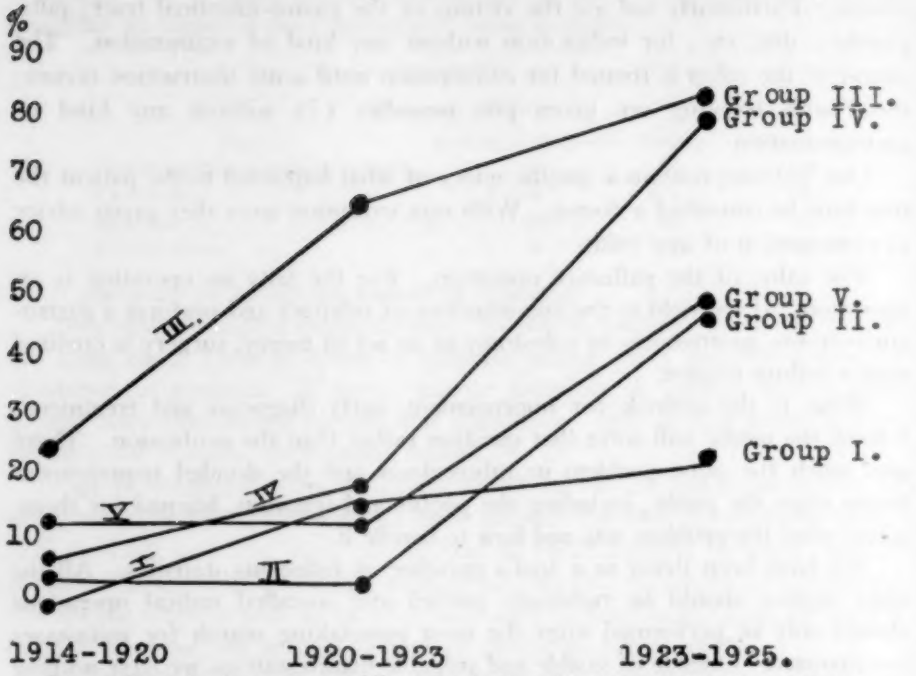

FIG. 1.—Curve showing percentage of X-ray examinations of carcinoma patients for metastases.

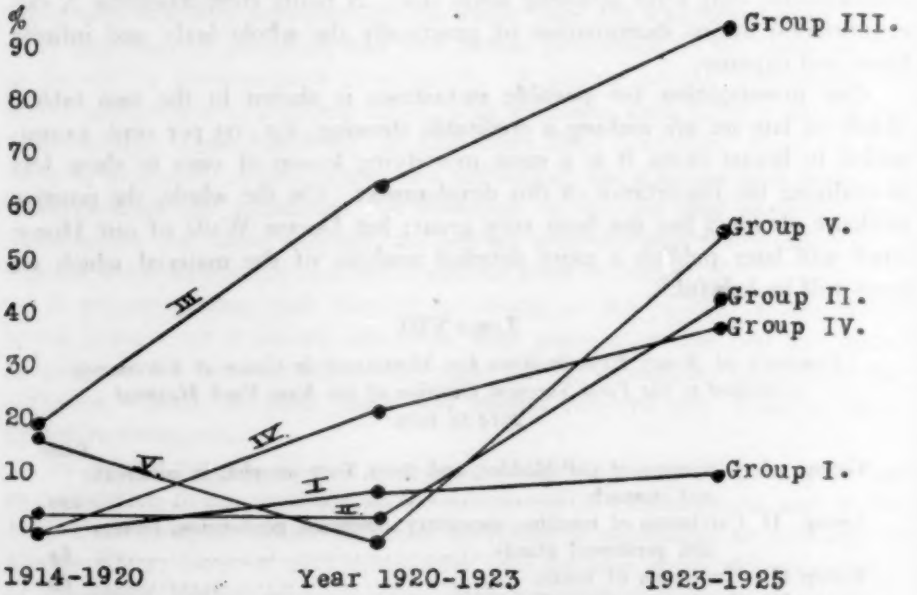

FIG. 2.—Curve showing percentage of X-ray examinations taken before operation on carcinoma.

performed. The post-operative radiation was used chiefly in the bad cases where operative outlook was poor. Most of the radiotherapy was given at the Memorial Hospital, to whom we are greatly indebted for its great helpfulness. As regards helpful results we can give no definite statement. We regret to record, however, that our personal impression is that no real improvement except moral effect of doing something has been attained by radiotherapy.

We realize that occasionally brilliant reports are circulated; but believe that these belong mainly to the class of patients we have cited as surviving many years despite obvious lesions. On the other hand, radiotherapy is often demanded by relatives and may involve needless expense, and there are unpleasant complications and discomfort. We think it is about time the partisans of radiotherapy published a study of results along the lines of this paper.

SUMMARY OF MALIGNANT TUMORS

(Explanation of symbols: (x)—Died following operation; *—X-ray or radium treatment; **—Never seen after discharge.)

Carcinoma of Appendix.—(7 operations, 4 living, 1 unknown.)

Radical operation—all.

1 (x).

1 died 3 years 9 months after discharge (recurrence in 6 months).*

1 unknown.**

4 living: History Nos.

5 years post-operative (198,728 and 226,443).

4 years post-operative (238,173 and 236,015).

Carcinoma of Breast.— (76 operations, 17 living, 7 unknown).

Radical operation—75.

1 case partial excision only as case was clearly hopeless.

1 (x).

50 died after discharge (20*).

1 died eleven years after operation, at the age of 70, of apoplexy. Breast condition absolutely all right (191,293).

Living cases—No recurrence.

10½ years (199,164).

8 years 4 months* (210,519).

6 years* (226,531).

5 years (232,135).

4 years 6 months (200,460, 237,187).

3 years 5 months (241,982).

2 years (252,008,* 248,946*).

1 year (258,406, 257,360,* 255,532*).

9 months (252,137*).

Living cases—recurrence.

9 years post-operative. Site of operation O.K. Operation for carcinoma of opposite breast (263,577).

Recurrence 3 years post-operative. Living 9 months later (239,517).

Recurrence 1 year post-operative.* Living 4½ years later (229,198).

Recurrence 4 years post-operative.* Living 3 years later but condition very poor (220,740).

Appearance of Metastases

Within 6 mos.	Within 1 year	2 yrs.	3 yrs.	4 yrs.	5 yrs.	6 yrs.	9 yrs.
13	11	13	7	4	3	2	1

Unknown (7).

1,** 3 months O.K.; 4 months O.K.; 6 months O.K.; 9 months (1 O.K.; 1 recurrence); 3 years O.K.

Carcinoma of Bartholin's Gland.—(1 operation, 1 death.)

1 case—radical operation—metastasis within 4 months, dead 8 months post-operative.

Carcinoma of Bladder.—(8 operations, 7 deaths, 1 unknown.)

Excision of tumor—3 cases.

1 (x).

1 died 2 months post-operative.

1 died 5¼ years after discharge of a condition in no way related to her carcinoma. Never had a recurrence. She was in her 73rd year at the time of her death (217,091).

Exploratory—1 (x).

Cystostomy—4.

1 (x).

1 died 8 months post-operative.

1 died following second operation 1 year later.*

1 unknown. Followed 16 months—unimproved.

Carcinoma of Buccal Mucous Membrane.—(1 operation, 1 unknown.)

Excision by cautery. 3 months post-operative all right. Never seen again.

Carcinoma of Broad Ligament.—(1 operation, 1 unknown.)

Excision of tumor.**

Carcinoma of Œsophagus.—(4 operations, 3 dead, 1 unknown.)

Gastrostomy—4.

2 (x).

1 died 1 month post-operative.

1 distinctly weaker one month after discharge. Never seen again.

Carcinoma of Face.—(6 operations, 1 death, 4 living, 1 unknown.)

Radical operation, excision of tumor, in all cases.

1 died 2 months post-operative. At time of operation metastatic lymph-nodes removed.*

Living—no recurrence.

6 years (192,637).

5 years (203,160).

2 years 10 months (243,674).

10 months (252,345).

Unknown.

11 months post-operative O.K. Never seen again.

Carcinoma of Gall-bladder.—(15 operations, 15 deaths.)

Cholecystostomy—died 2 months later.

Cholecystotomy (x).

Cholecystenterostomy—died 5 months post-operative.

Cholecystectomy—3.

2 (x).

1 died 5 months post-operative.

Cholecystocolostomy (x).

Exploratory—7.

2 (x).

3 died 1 month post-operative.

1 died 3 months post-operative.

1 died 4 months post-operative.

Exploratory and nephrectomy (x).

NOTE.—All patients dead within 6 months.

Carcinoma of Intestines.—(50 operations, 41 deaths, 3 living, 6 unknown.)

Exploratory—19. (All known cases are dead.)

8 (x).

6 died within 6 months.

1 case had had 1st and 2nd stage Mikulicz for diverticulitis 10 months previously. Died 3 months after 2nd operation.

1 died 2½ years post-operative (definite metastases in liver 7 months post-operative).

Unknown—3.

2 **.

1 followed 5 months. At that time losing weight and strength rapidly.

Radical operation—31.

18 (x).

1 metastasis 2 months, dead 4 months post-operative.

1 died 1 month post-operative.

1 died 6 months post-operative.

1 metastasis 1 year, dead 4 months later.

1 metastasis 3 years 8 months, dead 1½ years later.

1 metastasis 1 year, dead 2 years post-operative.

1 died following operation in Greece 2½ years after operation here. Nothing known about metastasis.

Living—3.

No recurrence—(2).

223,299—7 years.‡

238,479—3 years. 7 months.

Recurrence (1).

256,805. Recurrence in uterus 1 year later.

6 months later still living but condition hopeless.

Unknown—3.

1 **.

1 recurrence 1 year later. Never seen again.

1 O.K. 2½ years post-operative. Never seen again.

Carcinoma of Kidney.—(2 operations, 1 living, 1 dead.)

Nephrectomy—2.

1 metastases to brain, 3 years 7 months post-operative. Died 1 month later.

1 living, 2 years 2 months post-operative O.K.

Carcinoma of Larynx.—(2 operations, 2 deaths.)

1 tracheotomy.* Radium treatment following operation. 1 year after operation, report from Memorial Hospital, "Process certainly at a standstill. 3 examinations show absence of carcinoma." Died 1 year 7 months later.

1 gastrostomy. Died 2 months later.

Carcinoma of Leg.—(1 operation, 1 death.)

Amputation below knee. Metastases in brain 3 months post-operative. Died 5 months later.

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‡ Has already been quoted as living with no complaints notwithstanding metastases found at operation.

Carcinoma of Lip.—(10 operations, 3 deaths, 2 living, 5 unknown.)

Excision of tumor (10).

Died.

1—Huge recurrence 1 year 2 months after discharge. Died 3 months later.

1*—recurrence 10 months post-operative. Came in for removal of nodes under chin. Radium treatment of no avail. Died 4 months later.

1 died 2 years post-operative. Date of metastases not known.

Living. (No recurrence.)

2 O.K. 5 years post-operative (194,357, 204,681).

Unknown.

2 **.

1 O.K. 2½ years post-operative. Never seen again.

1 came in 3 months after discharge for removal of cervical nodes—a prophylactic measure. Microscopic showed no evidence of metastasis. Patient never seen again.

1 O.K. 6 months after discharge. Never seen again.

Carcinoma of Liver.—(11 cases—all exploratory—all dead.)

Carcinoma of Lymph-nodes.—(7 operations, 5 deaths, 2 unknown.)

Carcinoma of Maxilla.—(2 operations, 1 death, 1 unknown.)

Carcinoma of Nose.—(1 operation, 1 death.)

Cauterization of tumor.* Died 9 months later.

Carcinoma of Omentum.—(2 operations, 2 deaths.)

Both exploratory—1 died 2 weeks after leaving hospital, the other 4 months.

Carcinoma of Pancreas.—(4 operations, 4 deaths.)

Cholecystostomy—2 (x).

Exploratory—2 (x).

Carcinoma of Penis.—(1 operation, 1 living.)

Living, no recurrence, 1 year later.

Carcinoma of Peritoneum.—(3 operations, 3 deaths.)

Exploratory—3 (x).

Carcinoma of Prostate.—(3 operations, 2 deaths, 1 unknown.)

Prostatectomy—3.

1 (x).

1 recurrence 10 months post-operative. Died 7 months later.

1 **.

Carcinoma of Rectum.—(12 operations, 10 deaths, 1 living, 1 unknown.)

6 colostomies.

1 living 3 years post-operative* (242,633); others all dead or hopeless.

Resections—3—all dead.

Exploratory—3—all dead.

Carcinoma of Retroperitoneal Nodes.—(1 operation, 1 death.)

1 (x).

Carcinoma of Stomach.—(69 operations, 4 living 6 unknown.)

Exploratory—32.

6 (x).

With exception of four unknown, all remaining cases died within 6 months.

Jejunostomy—4.

3 (x).

1 died 2 months after discharge.

Gastro-enterostomy—18.

7 (x).

5 died within 6 months.

2 died within a year.

1 had local deposits in scar 10 months after discharge. Died a year later.
1 case large mass 11 months post-operative. Still living 1 year post-operative.
1 unknown—O.K. 10 months post-operative.
1 died 18 months post-operative.

Resections—15.

Deaths.

8 (x).
1 died 1 month after discharge.
1 metastasis a little over a year. Died 1 year 7 months post-operative.
1 metastases 1 year later. Died 1 year 3 months post-operative.

Living—no recurrence.

3 years 8 months O.K. (240,504).
4 years 2 months O.K. (237,171).

Living—recurrence.

Recurrence 3½ years post-operative. Still living, 3 years 9 months post-operative (242,284).

Unknown.

1 **.

Carcinoma of Scrotum.—(1 operation, 1 living.)

Excision—no recurrence 5 years 11 months post-operative (226,595).

Carcinoma of Skin of Shoulder.—(1 operation, 1 death.)

Excision—recurrence 2 months post-operative. Died within a year.*

Carcinoma of Submaxillary Gland.—(1 operation, 1 living.)

Removal of tumor. O.K. 2 years 2 months post-operative (249,662).

Carcinoma of Testicle.—(1 operation, 1 death.)

Castration. Dead 1 year 4 months later.

Carcinoma of Thumb.—(1 operation, 1 unknown.)

Amputation of thumb. O.K. 4 months post-operative. Never seen again.

Carcinoma of Thyroid.—(1 operation, 1 living.)

Excision. O.K. 4 years 5 months post-operative (235,795).

Carcinoma of Tongue.—(7 operations, 1 living, 6 dead.)

Excision.

Deaths—6.

1 died 2 months post-operative.
1 * recurrence 1 month after discharge. Died 9 months later.
1 * recurrence 1 year 4 months post-operative. Died 1 year 8 months post-operative.
1 recurrence 9 months post-operative. Died 14 months post-operative.
1 enormous recurrence nodes of neck 3 years post-operative. Died 3 years 3 months post-operative.
1 * recurrence 2 months post-operative. Died 11 months post-operative.

Living—1.

Discharge cured 10 years post-operative (196,548).

Carcinoma of Tubes and Ovaries.—(13 operations, 10 deaths, 1 living, 2 unknown.)

Radical.

1 (x).
1 * died 3 months post-operative.
2 died 3 months post-operative (1 of these cases died of influenza).
1 died 11 months post-operative. Massive recurrence.
1 died 1 year 5 months after discharge.
1 died 2½ years after discharge.
2 unknown (1 O.K. 3 months after discharge).

Living—1.

O.K. 3 years 5 months post-operative (244,421).

Exploratory.

1 * died 5 months post-operative.

1 (x).

1 died 1 year 8 months post-operative.

Carcinoma of Uterus.

Hysterectomy—22.

4 (x).

1 died 6 months later.

2 recurrence within 6 months. Dead 10 months post-operative.

1 died 1 year post-operative.

1 recurrence 1 year later.* Second operation 2 years after 1st operation. Died 2 years later.

1 metastasis 2 years 3 months. Died 1 year 10 months later.

1 metastasis 1 year 6 months. Died 1 month later.

1 recurrence 2 years vaginal vault. Excision. Another recurrence 2 years later and died following second operation.

1 recurrence 2 years.* Died 1 year later.

1 hysterectomy for fibroids 1921. Biopsy and cauterization of cervix for carcinoma 3½ years later.* Recurrence 1 year later. Died 1 year 4 months after 2nd operation.

1 recurrence 2 months after discharge.* Died 11 months post-operative.

1 recurrence 3 months. Died 1 year later.

1 recurrence 7 months. Died following treatment with radium 2 years 3 months post-operative.*

Living.

1 O.K. 4 years 9 months post-operative (231,528).

1 O.K. 7 years 7 months post-operative (216,782).

1 O.K. 2 years 9 months post-operative (246,283).

Unknown.

1 patient went to Italy 7 months post-operative. No recurrence at that time. Never heard from again.

1 O.K. 3 months post-operative. Never seen again.

Cauterization—6.

2 died 1½ years later (1).*

1 died 9 months post-operative.

1 died 1 year later.

2 **.

Exploratory—4.

1 * progressively worse. Died 9 months post-operative.

1 died 2 months post-operative.

1 died 5 months post-operative.

1 died 1½ years post-operative.

Dilatation and curettage—biopsy (1).

1 * Bad condition 2 years 3 months post-operative (249,548).

Dilatation and Curettage, trachelorrhaphy, shortening of round ligaments (1).

1 * Good condition 3 years 4 months later (240,503).

Anterior colporrhaphy, perineorrhaphy, excision of tissue for diagnosis (1).

1 * Dead 1½ years later.

Closure of vesico-vaginal fistula—(1).

1 dead two months later.

Excision of tumor (1).

1 * followed by hysterectomy. O.K. 2½ years post-operative (245,830).

Carcinoma of Vulva.—(1 operation, 1 death.)

1 excision—marked recurrence 3 months. Died 6 months post-operative.

Endothelioma of Arm.—(1 operation, 1 death.)

Excision of tumor. Died 7 months post-operative.

Endothelioma of Face.—(1 operation, 1 unknown.)

Excision.* Unimproved 1 year 10 months post-operative. Never seen again.

Endothelioma of Lymph-nodes.—(7 operations, 3 living, 4 unknown.)

Excision.

Living—3.

2½ years post-operative (239,660).

6 years post-operative (198,479).

1 case excision of axillary lymph-nodes.* Recurrence in cervical lymph-nodes 4 years 7 months after 1st operation. 2nd excision.* O.K. 1 year 8 months after 2nd operation (224,496).

Unknown—4.

1 **.

1 extensive recurrence 3 months post-operative. End result not known.

2 cases O.K. 7 months after discharge. No further trace.

Endothelioma of Neck.—(1 operation, 1 living.)

Excision. O.K. 9 months post-operative (195,594).

Endothelioma of Ovary.—(1 operation, 1 living.)

Excision. O.K. 3 years post-operative (207,492).

Endothelioma of Parotid.—(4 operations, 2 living, 2 unknown.)

Excision.

Living—no recurrence.

3 years 9 months (239,510).

4½ years (196,858).

Unknown.

1 **.

1 O.K. 3 months. Not seen again.

Sarcoma of Abdominal Wall.—(1 operation, 1 death.)

Excision of tumor. Died 4 years post-operative.

Sarcoma of Axilla.—(1 operation, 1 death.)

Excision of tumor mass. Patient died 4 months later.

Sarcoma of Bones.—(13 operations, 6 deaths, 7 living.)

Radical excision or amputation.

Deaths.

1 (x).

3 within 6 months.

1 recurrence 1 year 8 months post-operative.* Died 2 years 4 months post-operative.

Living.

2 years 2 months (249,667)—Femur.

3 years 1 month (223,451)—Ulna.

4 years 10 months (233,356*)—Tibia.

5 years 7 months (228,446)—Radius.

6 years (221,900*)—Humerus.

8 years 7 months (206,054)—Femur.

10 years (194,540)—Humerus.

Incision and drainage and biopsy.

1 (x).

Sarcoma of Breast.—(2 operations, 2 deaths.)

Amputation (2).

1–2nd operation two weeks after 1st for new growth of abdomen (x).

1–recurrence 6 months. Dead 11 months post-operative.

Sarcoma of Gum.—(1 operation, 1 living.)

Excision—so far as sarcoma goes O.K. 10 years post-operative. Has an old pulmonary tuberculosis.

Sarcoma of Groin.—(1 operation, 1 death.)

Excision. Metastases in spine 3 months post-operative. Died within 9 months post-operative.

Sarcoma of Intestines.—(10 operations, 7 dead, 2 living, 1 unknown.)

Resections—5.

Dead.

1 (x).

1 died 1 week after discharge.

1 died 3 years 7 months later.

Living.

O.K. 8½ years post-operative (211,240).

Unknown.

1 **.

Ileostomy (1).

1 (x).

Exploratory—4.

Dead.

1 died in 1 month.

2 died in 4 months.

Living.

1 still living 2 years post-operative.* Bad condition (251,419).

Sarcoma of Kidney.—(2 operations, 2 deaths.)

Nephrectomy—2.

1 died 1 month post-operative.

1 died 6 months post-operative.

Sarcoma of Lymph-nodes.—(3 operations, 1 living, 2 unknown.)

Excision—2.

1 living and O.K.* 5 years 9 months post-operative (228,666).

1 unknown. Had a recurrence 1 year 3 months post-operative.

Exploratory—1.

No specimen. O. K. 10 months post-operative. Then went to Italy and not heard from again.

Sarcoma of Neck.—(1 operation, 1 living.)

Excision of tumor. O.K. 5¼ years post-operative (228,987).

Sarcoma of Ovary.—(2 operations, 2 deaths.)

Excision.

1 died 10 months post-operative.

1 recurrence 11 years post-operative. Died 7 months later.

Sarcoma of Spleen.—(2 operations, 2 deaths.)

Splenectomy—2.

1 (x).

1 died 3 months post-operative.

Sarcoma of Stomach.—(2 operations, 1 death, 1 living.)

Resection—2.

1 recurrence 10 months post-operative.* Died 1 year 5 months post-operative.

1 living—no recurrence, 5½ years post-operative (229,363).

Sarcoma of Rectum.—(1 operation, 1 unknown.)

Excision—1.**

Sarcoma of Testicle.—(1 operation, 1 death.)

1—castration—recurrence 1 year 7 months.* Died 3 months later.

Sarcoma of Tendon Sheath.—(1 living, 1 operation.)

Removal of tumor. O.K. 2 years 3 months post-operative (214,561).

Sarcoma of Uterus (1 operation, 1 living.)

Hysterectomy—O.K. 5 years 7 months post-operative (230,854).

Sarcoma of Upper and Lower Extremities (Not Bones).—(9 operations, 3 deaths, 3 living, 3 unknown.)

Radical excision (8).

Dead.

1–2nd operation 10 months after 1st operation. Died 1 year 2 months later.*

1–died 1 year 5 months post-operative.

Unknown.

2 **.

1 at end of 3 months was not well.

Living—no recurrence.

2 years 3 months post-operative (210,187).

2 years 9 months post-operative (246,458).

3½ years (241,185).

Exploratory (1).

Aspiration and biopsy of tumor of thigh. Died 2 months post-operative.

Hypernephroma and Teratoma.

Kidney.—(2 operations, 2 deaths.)

Nephrectomy—2.

1 died 1 month after discharge.

1 recurrence in 11 months.* Died 1½ years post-operative.

Retroperitoneal Nodes.—(1 operation, 1 death.)

Exploratory—1.

Died 3 months post-operative. (Primary growth testicle.)

Testicle.—(1 operation, 1 death.)

Orchectomy.* Metastases in lungs 5 months post-operative. Died 3 months later.

LATE RESULTS AFTER AMPUTATION OF THE BREAST FOR CARCINOMA*

By Alexis V. Moschcowitz, M.D.

and

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Thanks to the efforts of Halsted and Willy Meyer, the modern operative treatment of cancer of the breast may be said to have become standardized. Collective statistics bear proof that the number of patients alive and free from recognized carcinoma, from three to five years after operation, have increased measurably, as a result of the more radical and anatomically perfect operation. In 1924, Lane-Claypon, in an analysis of 20,000 cases of operated breast cancer collected from the literature of the world, tabulated the following results based upon a three-year period of apparent cure. Of 7029 patients operated upon, so to say incompletely, *i.e.*, before the advent of the Halsted-Meyer operation, 29.2 per cent. were free from recurrence after a three-year interval. On the other hand, of 8921 patients undergoing the complete operation, 43.2 per cent. were free from recurrence, after a similar period of time. The reported series of Judd and Sistrunk, Sistrunk, Greenough and Simmons, Primrose, Ochsner and Cabot in this country bear further evidence of the improvement in the operative results. I, too, shared in the general optimism pervading the literature, particularly in respect to the early cases of breast carcinoma. It was indeed a great surprise to me therefore that in 1924, B. J. Lee, in an admirable paper read before this Association, recounted the results obtained in the operative treatment of 87 primary operable cases of breast carcinoma, treated at the New York Hospital, all of whom have been followed for a period of at least five years, and reported only 15 per cent. to be alive and free from tangible recurrence. At that time, I determined, if possible to ascertain the results of our efforts in the treatment of breast cancer at Mt. Sinai Hospital † and it is the results of this investigation with a few conclusions drawn therefrom, that I wish to submit for your consideration.

For this purpose, we have reviewed the cases of breast carcinoma admitted to the wards and private pavilion of Mt. Sinai Hospital from January 1, 1915, to December 31, 1924. In all 374 patients were discharged with a clinical diagnosis of carcinoma of the breast, exclusive of those patients who were readmitted for the treatment of local recurrences or metastases. To be sure, we have been unable to use this entire material. Particularly is this true of patients treated in the private pavilion of the hospital. Regrettably, we found here a great number of pathological reports missing, and no

* Read before the American Surgical Association, May 26, 1926.

† I take this opportunity to thank all my colleagues on the staff for permission to incorporate their cases in this contribution.

cases in this entire series is considered either from a statistical standpoint, or is included in the follow-up report, unless a pathological report, unequivocably carcinoma, was affixed to the record. In a small number of cases, the pathological report upon a patient's first admission to the hospital was lacking; but if subsequent readmission for recurrence proved the excised specimen to be carcinoma, this was deemed sufficient proof that the original tumor was a cancer, and to permit inclusion of the case, both in the follow-up report and statistical data. A number of patients (these will be considered as a separate group in a subsequent paper) were discharged without operation; in some cases, operation was refused by the patient; in others, the presence of supraclavicular, or more distant metastases adherence of the tumor to the chest wall, or contra-indications apart from the local lesion, such as diabetes, pulmonary tuberculosis, etc., actuated the surgeon to withhold operative measures and to rely upon physical agents (X-ray or radium) as a therapeutic measure. This leaves for analysis 218 cases of proven breast carcinoma. Of this number, we have been able to follow 139 cases. Fourteen were followed for a period of 11 years; 26 for a period of at least 10 years; 31 for 9 years; 37 for 8 years; 56 for 7 years; 73 for 6 years; 89 for 5 years; 115 for 4 years; 125 for 3 years, and 139 for 2 years. The only explanation for the paucity in follow-up results is the fact that not all of the private records were open to us. A noteworthy fact, in spite of the difficulties encountered in following patients in a large metropolis, is that we were able to trace over 85 per cent. of our ward patients; this in face of a not altogether adequate follow-up system prior to 1922.

All of these 139 patients were considered to be primarily operable and were subject to the radical operation. We realize that anything short of a five-year follow-up is entirely inadequate, and we will stress particularly the 89 patients whom we have been able to follow for at least this length of time. This statement, we believe, should be emphasized, because in this small series, 14 cases have died of recurrent carcinoma ‡ after a period of five years of apparent well being. In parenthesis, we may add that we have abandoned the terms "cure" and "end results" and have substituted the less incriminating phrases "free from recurrence" and "late results." All follow-up data are based upon information secured prior to January 1, 1926. Since that time we have learned of two deaths in this series. These are indicated in Chart I. We have deemed it advisable to classify all known recurrences as deaths from carcinoma, even though the patient was still living when last heard from. We feel that in these instances, the patient is still suffering from carcinoma and that the primary operative objective, namely, the eradication of the disease, has been defeated.

Sex.—In this series, there were 214 females and 4 males, an incidence of

‡ As a general rule, we make the very important differentiation between recurrences and metastases. In view of the fact, however, that most of the cases that died, did not die under our personal supervision, but were followed by the Social Service Department, we have grouped both the recurrences and metastases together.

CHART I.

Year	Number of patients	One year			Two years			Three years			Four years			Five years			Six years			Seven years			Eight years			Nine years			Ten years			Eleven years		
		Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived	Died	Recur.	Lived
1915	14	0	4	10	4	1	5	0	1	4	0	0	4	0	0	4	0	0	4	1	0	3	0	0	3	1	0	2	1	0	1	0	0	1a
1916	12	1	0	11	6	0	5	0	0	5	2	0	3	0	0	3	0	0	3	0	0	3	1	1	1	1	0	0	0	0	0b			
1917	5	1	0	4	0	0	4	0	0	4	2	0	2	1	0	1	0	0	1	0	0	1	1	0	0	0	0	0						
1918	6	0	0	6	0	1	5	1	0	4	1	0	3	0	0	3	1	0	2	0	0	2	0	0	2									
1919	19	1	0	18	3	0	15	2	0	13	2	0	11	1	0	10	3	0	7	0	1	6c												
1920	17	3	0	14	1	0	13	2	0	11	1	1	9	1	0	8	2	0	6															
1921	16	3	0	13	3	0	10	4	0	6	2	0	4	2	0	2d																		
1922	26	6	0	20	1	0	19	2	0	17	4	1	12																					
1923	10	4	0	6	3	0	3	1	0	2																								
1924	14	2	1	11	2	2	7																											
No. of cases followed	139	21	5 139	113	23	4 139	86	12	1 125	66	14	2 115	48	5	0 89	31	6	0 73	23	1	1 56	15	2	1 37	6	2	0 31	2	1	0 26	1	0	0 14	1

(a) Patient died February, 1926, from intercurrent disease.
(b) One patient living with a recurrence.
(c) One patient died March, 1926, from carcinosis.
(d) One patient died March, 1926, from carcinosis.

1.8 per cent. of carcinoma of the breast in the male, which corresponds with the findings recently published by Judd and Morse. Of the three patients of whom we have follow-up notes, two are dead of recurrences at the end of one and three years and one is living free from any evidence of carcinoma over a period of four years.

Age.—Of the 218 cases, 12 were between 21 and 30 years of age; 59 between 31 and 40; 67 between 41 and 50; 46 between 51 and 60; 32 between 61 and 70; 1 between 71 and 80. In one case, the age was not mentioned.

TABLE I

Age periods	No. of cases	Per cent.
21–30	12	5.5
31–40	59	27
41–50	67	30
51–60	46	21
61–70	32	14.5
71–80	1	.5
Not mentioned	1	.5

It is almost impossible to evaluate the rôle of age in longevity; the presence of involved axillary glands, extent of the disease, etc., makes the comparison of one factor as opposed to the other almost impossible. Of the 89 cases which we have followed for at least a five-year period, 6 were operated upon before the age of 30. All of these cases have since died of carcinoma. The average duration of life after operation was 2 years. Of the patients who presented themselves for operation in the fourth or fifth decade of life, the average length of life after operation was three and one-half years. In this group, we count 13 patients who are at present living and free from recurrences. The average length of life in those patients operated upon after the sixtieth year was 4.2. Two of these patients are alive and well. It would seem, other factors being constant, that carcinoma of the breast in the young has a more malignant tendency; this impression corresponding to the well-known very malignant and rapid course of carcinoma of the cervix and rectum in the third decade of life.

As it may be of interest to show the relationship of the pathological glandular involvements in the various age groups, we append Table II, which shows this relationship in 56 patients who died in less than three years after operation.

TABLE II

Ages	No. of cases	Glandular involve.	Glands not involved	Not mentioned
21–30	6	5		1
31–40	13	11	2	
41–50	17	10	4	3
51–60	12	7	2	3
61–70	7	2	3	2

Trauma as an Etiological Factor in Breast Cancer.—In 78 cases of this series, trauma was specifically denied by the patient upon interrogation; 12 patients gave a history of a trauma, the time interval between the trauma and the appearance of a noticeable mass in the breast varied between six weeks and 24 years. The average time which elapsed was 8 months.

Preceding Breast Abscess.—Ten patients gave a history of a preceding mammary abscess. The time interval between the infection and the appearance of a mammary tumor was 10 years. In one case, a breast abscess was incised four weeks prior to admission to the hospital; but in this case it seems more than likely that the condition was an inflammatory carcinoma with necrosis. The very rapid recurrence (within one year) in this case would seem to substantiate the impression.

Previous Lactation.—Twenty-two patients, or a little over 30 per cent. of those where mention is specifically made regarding this point, never lactated. It would seem as though there were some predisposition to carcinoma in breasts that have not lactated.

Duration of the Tumor Prior to Treatment.—The average period elapsing between the time the patient first noticed the tumor and her entrance into the hospital for treatment was six months. It is interesting to note that in spite of propaganda and the employment of every means known to educate the laity and physician regarding the significance of a "lump" in the breast, the duration of the tumor mass in patients admitted in 1915 averaged six and one-half months, whereas in 1924, the duration was six months; hardly sufficient difference to make one feel justified in telling that any real progress has been made along these lines. It is interesting to note that of five patients followed at least five years, that a history of a tumor mass existed in one case for two and one-half years; in two cases five years, and in two cases, eight years, one patient lived nine years and then died of a recurrence, two are alive and free of visible recurrences at the present writing, and finally two promptly developed recurrences. The longest duration of a tumor mass, 12 years, occurred in a male patient without glandular involvement. This patient died three years after a radical operation of a recurrence. Broders first called our attention to what he calls the "index of malignancy," based upon cellular differentiation. Sistrunk and MacCarty, in an analysis of a series of breast carcinomata, based upon a histological study of the neoplasm, arrived at the conclusion that the duration of life following the operation was in no small measure dependent upon cellular differentiation, hyalinization and fibrosis. It would certainly seem as though some factors inherent in the neoplasm, or perhaps in the patient herself, predetermined some of these findings.

Location of the Tumor.—In 116 cases, the tumor occupied the left breast; in 102 the right. The location of the growth designated according to breast quadrants was as follows: 90 occupied the upper and outer quadrant; 22 the upper and inner quadrant; 24 the nipple region; 10 the lower and inner quadrant and 12 the lower and outer quadrant. In the remaining cases, no

definite mention of the breast quadrant harboring the tumor was made. The relationship of the position of the tumor to lymph-adenopathy will be discussed in considering lymph-node involvement.

Pathology.—The various tumors were all examined by the pathologist of the hospital, Dr. F. S. Mandlebaum, and were classified as is shown in Table III, which also shows the attendant lymph-adenopathy for the entire series.

TABLE III

Type of carcinoma	No. of cases	Lymph-nodes involved	Lymph-nodes not involved	Not mentioned
Scirrhus ca.	101	67	29	5
Medullary ca.	43	26	15	2
Medullary and Scirrhus ca.	15	11	3	1
Adeno-ca.	14	6	3	5
Duct-ca.	14	9	5	
Duct and papillary ca.	10	2	6	2
Carcinoma (unclassified)	6	2	3	1
Papillary ca.	5		4	1
Papillary ca. (from ducts)	3		3	
Papillary cystadeno ca.	3		3	
Gelatinous ca.	1	1		
Colloid ca.	1		1	
Carcino-sarcoma	1			1
Spheroidal ca.	1		1	
	218	124 (56%)	76 (35%)	18 (9%)

Table IV shows the type of tumor in the 89 cases followed at least five years, as well as the percentage of those alive and well, January 1, 1926.

TABLE IV

Type of tumor	No.	Percentage	No. of patients alive and well, followed at least five years	Percentage
Scirrhus ca.	42	60	8	19
Medullary and scirrhus ca.	7	10	1	14
Medullary ca.	8	11	3	37
Duct ca.	4	6	1	25
Papillary ca.	4	6	1	25
Adeno-ca.	2	3	1	50
Carcino-sarcoma	1	1+	0	
Papillary cystadeno ca.	1	1+	0	
Gelatinous ca.	1	1+	0	
	70¶	99	—	—

¶ The discrepancy in pathological reports and number of patients followed (89) is accounted for by the fact that some were classified merely as carcinoma and in a number of the recurrent cases, the pathological report is missing.

Table III reveals the different pathological types of breast cancer met with in this series, as well as the lymph-glandular involvement for each type,

as encountered at the operation. Table IV shows the different pathological types for 70 of the 89 patients followed for at least five years, with the percentage of each type and the percentage of patients alive and well in each group. Many of these groups are much too small to permit conclusions as to the relative benignty or malignity of one type of carcinoma as opposed to the other. There is one group, however, commonly classified with the breast carcinomata which seems to be relatively non-malignant. We refer to the papillary cyst adeno-carcinomata. In this series we encountered three cases. Two of the cases were treated by simple mastectomy, and will be referred to later. One died of a recurrence six years after a radical amputation of the breast.

Glandular Involvement.—Reference to Table III shows that 56 per cent. of the entire series revealed lymph-node involvement; 35 per cent. showed no evidence of lymph-node involvement; in 9 per cent. the presence or absence of lymph-node was not mentioned. Of 139 cases followed for a period of from 2 to 11 years, 59 per cent. showed lymph-node involvement; 30 per cent. were uninvolved, and in 11 per cent. no mention was made of the presence or absence of involvement. Of 218 patients, 106 gave palpatory evidence of some lymphadenopathy; the pathological findings, however, did not substantiate this in all the cases. It seems as though the tumors situated in the upper and outer quadrants of the breast gave a relatively higher proportion of glandular involvement; but our findings here are not in sufficient numbers to warrant a definite statement to this effect.

Follow-up Results.—We have attempted to simplify the interpretation of our follow-up results by combining in one chart (see Chart I) the number of patients we were able to follow each year, beginning with the year 1915 and continuing through 1924. At the top of the chart, we have in sequence the number of years it was possible to follow each group. We have, moreover, subdivided each year so that deaths and recurrences could be tabulated in the order in which they occur. These subtracted from the original number or from the number of patients alive and well at the end of any given yearly period, immediately reveals the number of patients still alive and well. Summarized, our effort at follow-up shows the following:

Of 139 cases followed one year there were 21 deaths, 5 recurrences, 113 or 81 per cent. living.

Of 139 cases followed two years, there were 23 deaths, 3 recurrences, 86 or 62 per cent. living.

Of 125 cases followed three years, there were 12 deaths, 1 recurrence, 66 or 52 per cent. living.

Of 115 cases followed four years, there were 14 deaths, 2 recurrences, 48 or 41 per cent. living.

Of 89 cases followed five years, there were 5 deaths, 0 recurrences, 31 or 34 per cent. living.

Of 73 cases followed six years, there were 6 deaths, 0 recurrences, 23 or 31 per cent. living.

Of 56 cases followed seven years, there was 1 death, 1 recurrence, 15 or 26 per cent. living.

Of 37 patients, followed eight years, there were 2 deaths, 1 recurrence, 6 or 16 per cent. living.

Of 31 patients followed nine years there were 2 deaths, 0 recurrences, 2 or 7 per cent. living.

Of 26 cases, followed ten years, there was 1 death, no recurrence, 1 or 4 per cent. living.

Of 14 cases, followed eleven years, there was 1 death (intercurrent), 0 recurrence, 0 or 0 per cent. living.

It will be noted that at the end of a five-year follow-up, 31 patients were alive and well out of a total of 89 cases followed. If we were to stop here and consider these patients as cures, our results would compare favorably with the results of other authors. (See Table V.)

TABLE V

Author	No. of cases	Percentage alive after five years
Judd and Sistrunk	514	38
Porter	22	27.7
Sistrunk	218	36.7
Bunts	341	26.9
Greenough and Simmons	69	32.0
Primrose	76	44.4
Deaver	150	26.0
Moschcowitz	89	34.0

I must confess, I had always thought, in spite of numerous reports of late recurrences after operation, that a case of breast carcinoma alive and well five years after operation, could almost be classified as a cure. I find, however, on the contrary, that in the sixth, seventh, eighth, ninth and even tenth year after operation, recurrences; to be sure, most of them metastases, which have claimed no less than 16 patients out of a total of 31, who at the end of a five-year follow-up period, were considered well. In one of these, death was due to an intercurrent disease. One of these patients is alive with a recurrence. In all the others, death was due directly or indirectly to carcinoma. *Of 89 patients followed at least five years, and in some cases for a much longer period, 15 at the present writing are alive and well, or a percentage of 17 per cent.*

Influence of Glandular Involvement on the Prognosis.—Of fifty-three cases, dead of carcinoma or with a recurrence within three years after operation, 81 per cent. had pathologically involved glands; 19 per cent. did not. Of the cases living four to five years, 60 per cent. showed no glandular involvement, whereas 40 per cent. did. Of cases living six to eight years, there were an equal number with and without glandular metastases; whereas of those few patients who lived, nine, ten and eleven years, all had glandular metastases. We were surprised to find that of those patients who lived for a period beyond 5 years, 50 per cent. had axillary glandular metastases, for we

were led to believe that this was most unusual. Whether this is due to the small series here presented or to the possible limited extent of the axillary involvement, is conjectural.

Recurrences and Metastases.—It is not an easy task in a series of this kind, where reports of deaths are obtained either from relatives, social workers, or from sister institutions who care for incurables, to establish with accuracy the number of local recurrences as opposed to distant metastases. The data, however, at our command showed the following: In the first year, 5 patients developed local recurrences; in the second year, four, and in the succeeding years there was a corresponding decrease in the number of local recurrences in contra-distinction to the number of deaths from distant metastases. For example, of those patients followed at least six years, six died of carcinoma during that year, but none of these, as far as our records show, developed local recurrences. The following distant metastases occurred in this series: Lung and pleura, 6 times; spine 3 times; supraclavicular nodes 3 times; liver 2 times; peritoneum 4 times. This must give rise to speculation and leads me to repeat what, I believe, I have expressed before this Association on a previous occasion, namely, that those patients who develop distant metastases, in the absence of any visible evidence of local recurrence, probably had extensions of the process into lymphatics beyond the operative field before they submitted themselves for treatment. In other words, the surgeon, in spite of the most radical operations, faces a condition against which he can hardly hope to cope. On the other hand, the question of local recurrence, I believe to be intimately bound up with the conditions as found at operation and these will vary in the main with the degree of axillary lymph-glandular involvement, adherence of glandular masses to the axillary vein or to the skin of the axilla or any other factor or factors which makes the surgeon feel for one reason or another that conditions were not suitable for a really radical operation. It is interesting to note that in the few cases in which the prognosis as to life expectancy or recurrence was indicated by the surgeon at the time of the operation, his judgment was borne out by subsequent events. We have not found that supraclavicular fulness following the radical operation is necessarily indicative of a beginning or established supraclavicular involvement, but rather believe that it is, in most cases, the result of a lymphaderna which involves the skin and subcutaneous tissues of the supraclavicular triangle. We have followed a number of patients over a period of years who have marked supraclavicular fulness, without any palpatory evidence of a recurrence here. On the other hand, its presence should make one suspicious of the possibility of supraclavicular lymph-node involvement.

Ulcerating and Inflammatory Carcinomata.—We have encountered three cases which answer the description of inflammatory carcinoma as described by Lee and Tannenbaum. All these patients developed prompt recurrence and a generalized carcinosis within six months after operation.

Bilateral Mammary Carcinoma.—Two cases presented themselves with what we took to be consecutive bilateral carcinomata. One patient is alive

and well 14 years after the first mastectomy and 7 years after the second. The other patient developed her second carcinoma 3½ years after her first operation and died of a recurrence 4 years after the second operation.

Sero-hemorrhagic or Hemorrhagic Discharge from the Nipple.—Five patients of this series presented themselves with a bloody discharge from the nipple. In each instance, a duct papillary carcinoma or a papillary cyst adeno-carcinoma was reported. In a similar length of time, the records show that nine patients admitted with a sero-hemorrhagic discharge possessed benign duct papillomata. One of us proposes to review this series.

Simple Breast Amputation.—In three instances (these are not included in the series) a simple mastectomy or local excision for a papillary cyst adeno-carcinoma of the breast was done. One patient followed for two years was alive and well when she was lost sight of. One patient is alive and well four years after operation; the third patient could not be traced.

Pre-operative and Post-operative X-ray Therapy.—In six patients of those we have been able to follow, prophylactic X-ray radiation was employed prior to the operation. Three of those are alive and well for periods of 2, 3 and 5 years. Three have had recurrences. It is almost impossible for us to accurately evaluate the benefits of either pre-operative or post-operative radiation. We are employing post-operative radiation almost as a routine measure at the present moment, but have seen recurrences begin and increase in size in areas treated most intensively. Too many other factors enter into consideration. A number of patients who are now alive and well and who are included in the follow-up statistics have received the benefit of post-operative radiation. How much this has influenced longevity is conjectural.

CONCLUSIONS

1. A follow-up of three years after amputation of the breast cannot be considered as of great value.

2. Even a follow-up of five years cannot be considered as absolutely conclusive; too many patients die after this period from recurrences or metastases.

3. For all practical purposes, the fate of the patient is sealed at the time of the operation. The prognosis depends upon three factors:

   a. The local extent of the process.

   b. The presence of distant metastases.

   c. The care with which the operation is done.

4. The modern operation is usually successful in eradicating the local process, as is evidenced by the very large number of cases dying from distant metastases, without even a suspicion of a recurrence.

5. At the present writing, we are practically powerless in the presence of distant metastases.

6. The late results of the operation are not as favorable as one might be led to believe from a cursory examination of the literature.

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THE CAUSES OF CICATRICIAL CONTRACTION *

By J. Shelton Horsley, M.D.
of Richmond, Va.

Not infrequently there has appeared in surgical literature a statement, or at least a suggestion, that defects in the common bile duct or in the ureter would be satisfactorily repaired simply by epithelium covering the defect. This idea has been the basis of procedures in which a rubber tube or a catheter was placed in the common duct or in the ureter, expecting the epithelium to grow over the tube from each end of the divided duct or ureter and that when the epithelial covering was complete there would be practically perfect repair. Or tubes of fascia or a segment of vein would be used with the expectation that after the epithelium had covered the interior of the transplant, permanent function would be established.

Fig. 1.—Frances K. Deformity from cicatricial contraction of the left side of neck and the left pectoral region.

Strictures, however, are usually covered with epithelium. The histologic examination of a stricture, or of any cicatricial contraction about the face, often shows an epithelial covering that is not far from normal. Hunner and Wharton have sections of blocks from a stricture of the ureter in which the epithelial coat is preserved and the pathologic changes are in the other tissues. In cicatricial contractions about the head and neck, which are common after burns, the epithelial covering is practically normal, but the contraction is due to the scar tissue beneath. The maximum contraction usually occurs after the surface has healed and is entirely covered with epidermis.

A little white girl, F. K., five years old, admitted to the hospital December 16, 1925, was burned one year before admission. There was on the left side a very severe contrac-

* Read before the American Surgical Association, May 24, 1926.

tion of the head and neck, and the upper arm was adherent to the body. (Fig. 1.) A plastic operation was done and the excised scar tissue was studied histologically. Even in the region of greatest contraction and densest scar tissue the epidermis was practically normal.

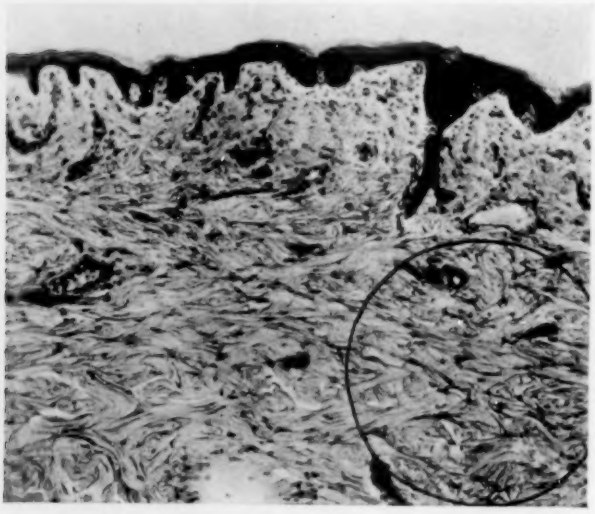

FIG. 2.—Mrs. F. Normal skin from chest. Note the epidermis, with a section of a duct to a sweat gland which has been cut partly obliquely, and the structure of the connective tissue of the corium. (X 60.)

A comparison of sections from an area of this contraction with those from normal skin is interesting. Figure 2 is a photomicrograph of normal skin from the chest of a woman operated upon for mammary carcinoma, the skin being taken from the margin of the gross specimen. When compared with Figure 4 from the densest mass of scar tissue in the neck (Fig. 1), but little difference can be seen in the two epithelial coverings. The contraction is due to the replacement of the true corium by dense scar tissue. As corium consists chiefly of connective tissue and the scar is connective tissue, the histologic difference between these structures is not marked. Figures 6 and 8 show sections from the pectoral and the axillary contractions of F. K. (Fig. 1). There is an essentially normal epithelial covering. Sections from cicatricial contractions elsewhere in this patient present the same type of epidermis.

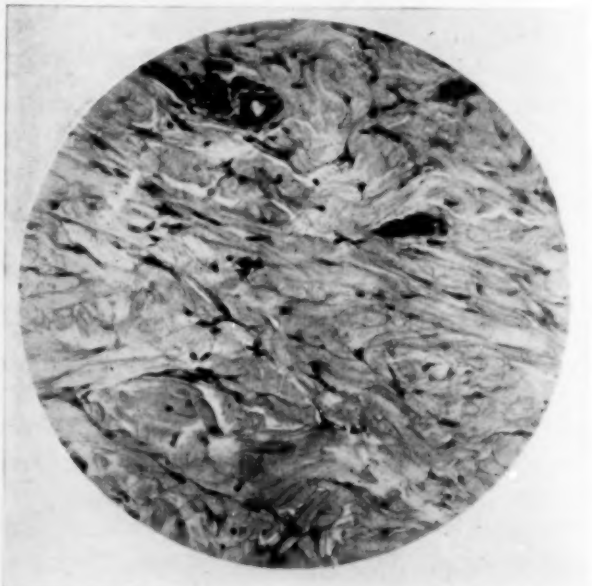

FIG. 3.—Mrs. F.—Higher magnification of the connective tissue in the preceding photomicrograph. (X 150.)

Figures 11 and 12 are from a section of a scirrhous cancer of the breast in which there was marked contraction. The connective tissue is in very dense bands; there are occasional areas of apparently degenerated tissue and some carcinomatous cells arranged in typical acini. Figure 13 is a photomicrograph of a section from a cirrhosis of the liver in which there was contraction. The connective tissue is in approximately straight fibres with considerable leukocytic infiltration due, doubtless, to the irritating effect of the toxic substance that caused the cir-

rhosis. In a slowly growing carcinoma of the colon, in which there was marked cicatricial contraction, the photomicrograph shows connective tissue much of which is wavy. (Fig. 14.)

When the histologic structure of a contracting scar (Figs. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14) is compared with a scar in which there is no contraction (Figs. 15, 16, 17 and 18), it is seen that there is no essential difference. The epidermis over a non-contracting scar is also apparently normal. In Fig. 16, scar tissue of a non-contracting scar is in contact with the normal corium. The tissue is from the abdominal scar of an operation done two years ago, the scar being excised during a later operation. The tissue in a non-contracting scar in the breast (Fig. 15) contains some of the wavy type of connective tissue. Theoretically it would seem that the wavy type, in which there is contraction of the total length of the connective-tissue fibres would produce the greatest contraction. This type was found in carcinoma of the bowel (Fig. 14) and in some of the sections from cicatricial contraction of the neck (Figs. 6 and 7), but it does not show in the scirrhous cancer of the breast (Figs. 11 and 12) nor in the cirrhosis of the liver (Fig. 13). It also occurs in non-contracting scars (Figs. 15, 16, 17 and 18).

FIG. 4.—F. K. Photomicrograph of the dense cicatricial tissue from the neck of patient shown in Fig. 1. Note the comparatively normal epidermis. The connective tissue shows regions of leukocytic infiltration. (X 60.)

Various types of connective tissue are found in cicatricial contraction. In Figs. 6, 7 and 14 there is a wavy type, but in Figs. 5, 8, 10, 11 and 12, also from an area of contraction, the connective tissue is in dense straight bundles. When compared with sections of normal skin (Figs. 2 and 3), or of non-contracting scars (Figs. 15, 16, 17 and 18), no fundamental histologic difference in the connective tissue can be seen.

A histologic comparison of the connective tissue from all these sections does not seem to give any clew to the cause of contraction. It appears that we must look elsewhere than to the microscopic study of the connective tissue constituting the scar.

The origin of connective tissue has been the subject of interesting research in recent years. George A. Baitsell seems to have shown that connective tissue in the chick embryo and in the amphibian begins as a "transparent, gelatinous, cell-free ground-substance which, in general, pervades the embryonic body from very early stages of development," and which he thinks is a secretion of the cells of the various germ layers and has no connection with a syncytium or any transformation of the cytoplasm. Fibrillation later occurs in this ground-substance and increases as the embryo grows. "The formation of the ground-substance is followed by the invasion of the mesenchyme cells which, using it as a supporting material, apparently in the same way that cells utilize the plasma clot in tissue cultures, move through and modify it in various ways."

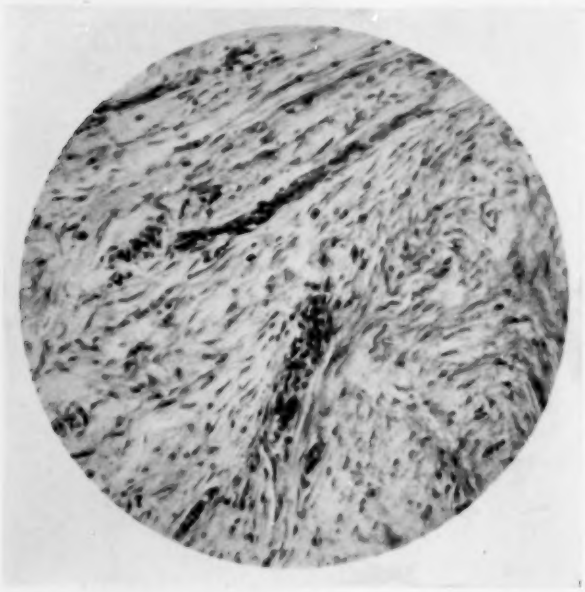

FIG. 5.—F. K. Higher power view of another field of the same slide from which the preceding photomicrograph was made. (X 150.)

Hertzler has found that in certain conditions peritoneal healing may occur by direct transformation of the fibrin without the intervention of granulation tissue. Where there is a distinct granulation tissue, however, the process of healing is more complicated and there seems to be a transformation of the cells of the granulation tissue into connective tissue, though some of the connective tissue may be from direct changes in the fibrin, as has been suggested by Hertzler and by Baitsell. According to H. E. Jordan, of the University of Virginia, lymphocytes are the chief elements in the organization of scar tissue. Carrel has shown that leucocytes have a growth promoting function. Jordan and Speidel have shown that this "trephonic" action is probably located in the lymphocytes. Moreover, Carrel and Ebeling have demonstrated by tissue culture methods that lymphocytes may differentiate into fibroblasts, confirming the earlier claims of Policard and Desplas and of Renaut.

According to H. E. Jordan, the fibroblasts of the developing scar tissue apparently have origin chiefly from lymphocytes, in small part from the local connective-tissue cells stimulated to proliferative activity by the presence of leucocytes, and possibly in very small part also from endothelium (Mallory). The variable origin of the fibroblasts from lymphocytes, connective-tissue cells

and endothelial cells is explicable on the basis of the close genetic relationship among these only slightly differentiated elements of the original mesenchyme.

Scar tissue is a type of connective tissue which is a low order of tissue and may be compared with more highly differentiated tissues, as the invertebrates in a zoological classification are compared with mammals. The lower order of animals show a high capacity for repair and the ability to live under conditions that would be fatal to the more complex higher animals. The different tissues in man also have varying capacities for surviving injuries and for repair. The delicately constructed and more recently evolved cortical brain tissue repairs not at all, whereas connective tissue, one of the primal tissues, repairs almost perfectly. Between these two extremes there are different degrees of ability to repair. When conditions are such either from toxic or traumatic injury or from lack of nutrition that more highly differentiated tissues cannot survive, connective tissue often may live.

FIG. 6.—F. K.—A section from the upper pectoral region of the contracting scar (Fig. 1) showing the epidermis practically normal with connective tissue arranged in dense columns in the upper portion of the photomicrograph, and in wavy bundles in the lower portion. (X 60.)

While there is no direct relation between an epithelial covering and cicatricial contraction, because contraction is due to the connective-tissue element, the epithelial covering may have an indirect effect. If a granulating surface persists for a long time, there is a tendency for an excessive amount of connective tissue to form. The soft granulation tissue is easily traumatized and each trauma is a stimulus for additional granulation tissue and subsequent connective-tissue formation. If this raw surface is covered with epithelium, as with Thiersch grafts, the epithelium acts as a protection from further trauma. After scar tissue has formed, however, the epithelial covering does not prevent contraction. If cicatricial contraction in the skin is to be corrected, the whole skin should be used as a transplant. Where the normal corium is thin and the nutrition good, as in the eyelids, there may form under the Thiersch grafts a new corium of connective tissue which will have but

little tendency to contract. Thiersch grafts do not, as a rule, prevent a recurrent contraction, though they may in some instances mitigate it.

The causes of cicatricial contraction can be classified roughly under two heads, direct and indirect. The direct cause is a toxic substance which in the last analysis is, of course, chemical and consists of products formed outside of the body cells, as from bacteria, or produced within the cells, as when they are affected by radiant energy. The indirect causes may be considered as predisposing.

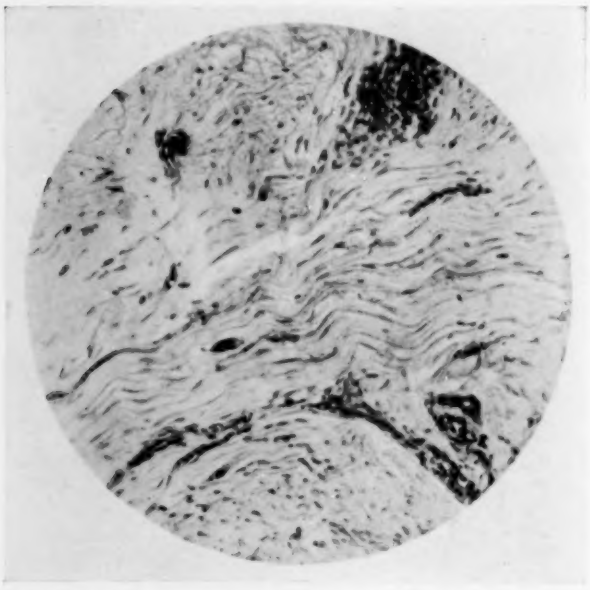

FIG. 7.—F. K. The connective tissue from the lower portion of the preceding figure, showing the wavy fibres of the connective tissue with regions of leukocytic infiltration. (X 150.)

1. *Direct causes, cicatricial contraction: toxic products produced by,*
   - (a) *Burns (by heat, light, or electricity).*
   - (b) *Chemicals.*
   - (c) *Bacteria.*
   - (d) *Cancer.*
   - (e) *Trauma, and cells affected by lack of blood supply.*
   - (f) *X-ray or radium.*

2. *Indirect causes:*
   - (a) *The general disposition of the individual toward scar tissue formation.*
   - (b) *The portion of the body affected.*
   - (c) *The absence of strain or tension on the scar.*
   - (d) *Lack of proper blood supply.*
   - (e) *The absence of natural resistance toward physiologic secretions or excretions.*
   - (f) *The quantity of scar tissue.*

1—(a) Cicatricial contraction is particularly noticeable after burns. This is probably chiefly due to the fact that along the margin of the completely destroyed tissue there is a zone in which the cells are injured but not killed, and sooner or later the more highly differentiated of these cells will be replaced by connective tissue. The toxic product from burns may result partly from destruction of the cells and partly from substances developed within those cells injured but not completely destroyed. Often a burn is complicated in healing by infection when the toxins of bacteria are added.

1—(b) Toxic products from chemicals, as after injuries from strong acids or alkalies, doubtless are formed in much the same way as from burns, the chemical itself having a directly destructive action with a zone in which cells are injured but not completely destroyed.

1—(c) The toxic products from bacteria are probably chiefly elaborated from the bacteria themselves, but partly also from contact of these toxins with living tissue. The effect of bacterial toxins are often rather far-reaching. Aside from infection of a wound, which causes necrosis of the local tissue and injury of the adjoining cells, milder toxic bacterial products gain access to the circulation and sometimes seem to have a specific action upon certain tissues. Thus, cirrhosis of the liver (Fig. 13) may be caused by the toxins of the colon bacillus, or from toxic products supplied through the spleen as well as from the chemical toxic products from alcohol or chloroform. Dupuytren's contraction, due to cicatricial bands in the palm of the hand over the flexor tendons of the little and ring fingers formed without apparent trauma, has been puzzling. Leonard W. Ely, of Stanford University, thinks the first step in the treatment of Dupuytren's contraction should be the removal of foci of infection in the teeth or in other portions of the body with the idea that bacterial products from these foci have an affinity for the fascia of the palm of the hand. The affinity of certain streptococci for the mucosa of the pyloric portion of the stomach and for the duodenum has often been emphasized by Rosenow, who believes these bacteria cause peptic ulcers and inflammation in these regions—lesions which not infrequently result in cicatricial contraction and stenosis.

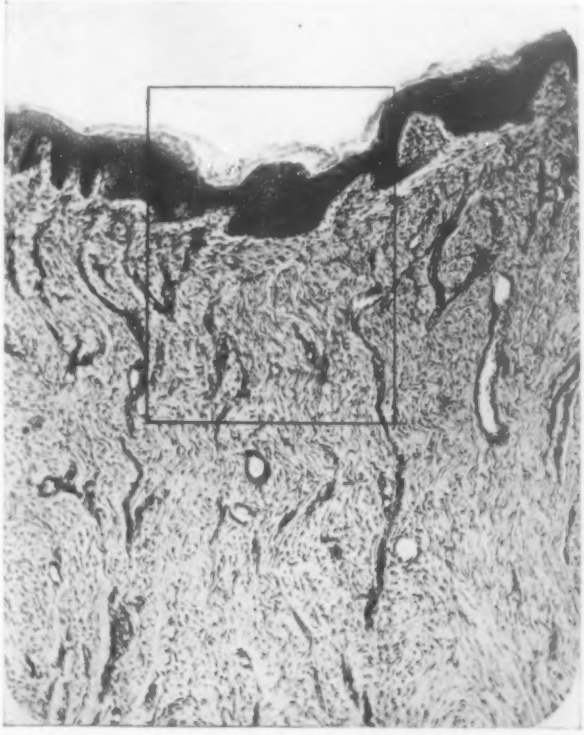

FIG. 8.—F. K. A section from the axillary region of the contracting scar tissue (Fig. 1), showing normal epidermis with connective tissue in wavy formation arranged at right-angles to the epidermis, with many newly formed vessels. (X 60.)

1—(d) Malignant disease causes reaction in the surrounding tissue. If a cancer grows rapidly, cells and nutrition are abundant and the disease may run its course before there is opportunity for the secondary and slower

changes of mature connective-tissue formation to occur. In the more slowly growing cancers, however, the reaction from the toxins elaborated during the growth of the cancer cells cause marked connective-tissue formation and cicatricial contraction within the tumor itself. This is commonly seen in the breast, as scirrhous cancer, and in certain cancers of the large bowel (Figs. 11, 12 and 14).

1—(e) Trauma may produce a defect by removing or destroying a large mass of tissue, or may injure only a few cells. Between these extremes there are many degrees of injury. Trauma seems to produce toxins by its effect on the tissue cells which in their degeneration release these products. If this were not true the stimulus for repair would not occur. Multiple and frequently repeated mild traumas before scar tissue has fully developed tend to increase scar tissue formation; but after the maturity of the scar a mild repeated trauma, such as massage, often causes some absorption of the scar tissue. Tissue cells necrotic or degenerating from lack of blood supply doubtless produce toxic products, as do cells affected by trauma.

FIG. 9.—F. K. Higher power view of the epidermis and scar tissue immediately beneath it, shown in the preceding photomicrograph. The scar tissue is dense and immediately beneath the epidermis is parallel to the surface, but beneath this layer columns appear at right-angles. (X 150.)

1—(f) Cicatricial contraction following X-ray or radium burns presents several interesting problems. These scars are usually very painful. The pain apparently is largely ischæmic and due to the lack of blood supply, which in turn seems to be induced by the action of the X-ray or radium in stimulating the endothelial lining of the blood-vessels and causing the endothelium to proliferate and occlude the vessels. As has been discussed before, scar tissue being able to survive when more highly differentiated cells cannot, the resulting lesion from intensive application of X-ray or radium, which injures tissue cells and so produces toxic products, consists largely of scar tissue. In Fig. 19 is shown a slightly contracting scar following an X-ray burn. In this

patient, a dentist who did his own X-ray work, the inner side of the thigh had been frequently exposed to the X-ray. There followed ulceration which healed except at the central portion. An examination of the excised tissue showed at one small point squamous-cell cancer. In other areas there was merely hypertrophy of the epithelium, beneath which was scar tissue with obliterated vessels. Figures 20 and 21 show one of the vessels almost entirely obliterated apparently by proliferation of its intima. In scar tissue from burns or bacterial infection, there appears to be no unusual effect upon the endothelial lining of the blood-vessels.

FIG. 10.—F. K. Connective tissue from the posterior axillary region of the contracting scar. (Fig. 1). The bundles, many of them in cross-section, seem dense, with no tendency toward wavy formation. (X 150.)

It is well known, too, that scars from X-ray or radium lesions are peculiarly prone to develop cancer. Montrose T. Burrows, of St. Louis, has elaborated a theory that cancer is initiated by an impaired circulation which permits stagnation around a group of cells of a by-product of the cells called archusia, corresponding to vitamin B. It is interesting to note that in the only type of scar in which the circulation is peculiarly impaired by occlusion of the vessels there is a decided tendency toward cancer. Without endorsing this theory of Burrows, coincidence of these conditions demands attention.

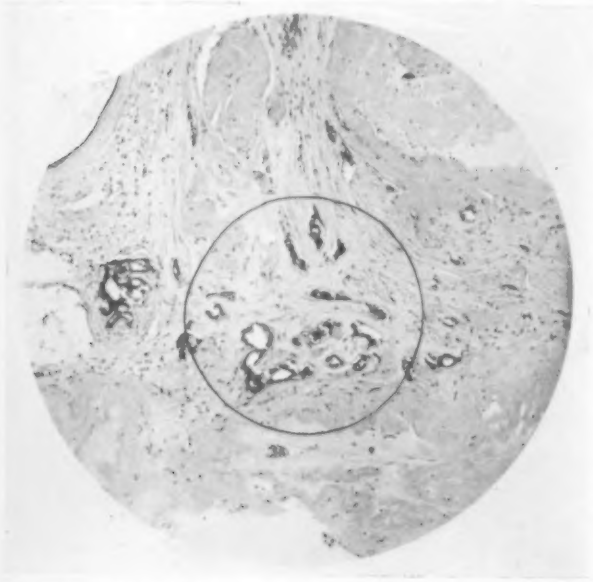

FIG. 11.—Mrs. M. A section from a scirrhus carcinoma of the breast. There are dense connective-tissue bundles with their fibres straight, areas of degenerated tissue, and a typical acini of cancer cells. (X 60.)

2—(a) Among the indirect causes of cicatricial contraction is a certain idiosyncrasy. In some persons scar tissue forms more readily than in others. A small scar, for instance, which is merely linear soon after an operation, weeks or months later without apparent cause may develop into a large, broad, scar. This is not always accompanied by contraction, and frequently such a scar is quite cellular, and is called a keloid. In some true keloids, however, even when there is no contraction, the connective tissue appears very dense.

FIG. 12.—Mrs. M. Photomicrograph giving higher power view of a portion of the preceding picture. The connective tissue shows well in the upper right-hand side, and is exceedingly dense. (X 150.)

2—(b) The portion of the body involved has much to do with the development of cicatricial contraction. It is well known that scars in certain regions of the body do not contract, whereas in other regions scars of apparently similar nature produce marked contraction. Every surgeon avoids a longitudinal scar in the palm of the hand, in the axilla, or in the middle of the neck, whereas a transverse scar in these regions does not contract. Longitudinal scars on the flexor surfaces as in the popliteal region, in the front of the elbow, and particularly in the axilla or on the anterior surface of the neck, are very prone to contract. Longitudinal scars in the axilla or in the anterior surface of the neck seem

FIG. 13.—A section from cirrhosis of the liver. The connective tissue is rather dense with straight fibres. There is considerable leukocytic infiltration. (X 60.)

to be more likely to contract than in the popliteal region or in front of the elbow. This may be due to the fact that in these latter regions the normal position for the limb at rest is fully extended, whereas in the front of the neck or in the axilla the normal resting position is for the head or the arm to be flexed; they are never fully extended at rest.

2—(c) An indirect cause of cicatricial contraction is the absence of pressure or tension. This is a noted feature of scar tissue, that it will tend to contract when there is no strain on it, or to stretch when there is. In this respect it differs somewhat from normal connective tissue with which it may be histologically almost identical. Though frequent traumas in the process of healing may add to the scar, later when the scar is mature, measures that produce increased circulation and increased metabolism not infrequently cause some of the scar tissue to disappear. The tension on an abdominal scar may induce such a change, and so weaken the whole scar. In certain locations intermittent stretching tends to decrease the scar and to make it give way. Strictures of the urethra, for example are often cured by the occasional passage of a sound, and the cicatricial tissue, from being rather dense at the stricture, may almost entirely disappear. The tension on the scar of an abdominal wound, however, is almost constant. Before the Bassini operation came into vogue the late Charles McBurney devised an operation for the cure of hernia which was founded on excessive scar tissue formation. Dr. William B. Coley in a letter of May 6, 1926, has given me his personal recollections of this operation, as he was house surgeon in the New York Hospital at the time McBurney brought it out. The technic consisted in leaving the wound widely open and stitching the skin on either side to the bottom of the wound so that granulations came from the bottom up. The entire wound was then carefully packed.

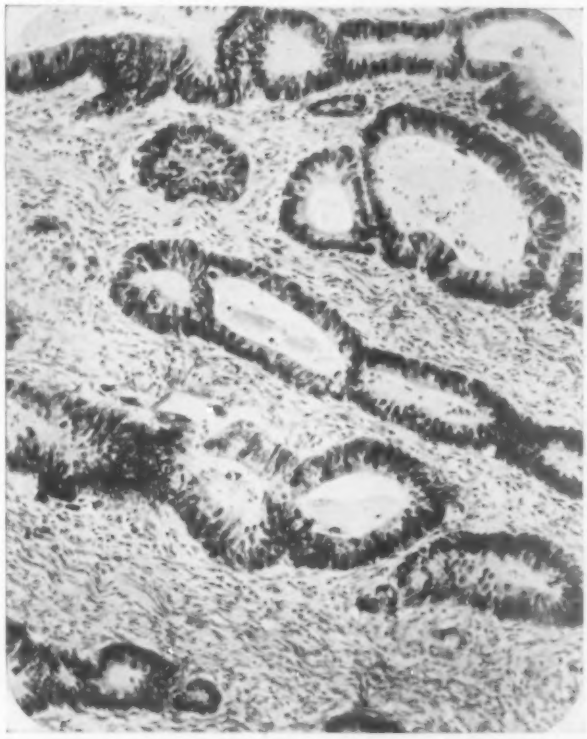

FIG. 14.—Mrs. S. A slowly growing cancer of the colon which produced a marked stricture. Note the wavy lines of the connective tissue, which is exceedingly dense. (X 150.)

The operation was based upon the idea that the dense scar tissue would form a barrier against recurrence. Doctor Coley says: "As a matter of fact, however, the scar tissue very quickly began to yield and in most of the cases in which the operation was performed at the Ruptured and Crippled, a recurrence took place within the next few years."

2—(d) The lack of proper blood supply may predispose to the formation of cicatricial contraction. This sometimes acts by lowering the resistance of the tissues to bacterial invasion and so increasing the scar, or, in a transplanted flap, even without infection, the nutrition may be at so low an ebb that while the more highly differentiated tissue cannot survive, the lowly scar tissue will flourish and dominate. A striking illustration of the replacement of a higher class of tissue by contracting scar tissue is in atrophy of the testicle when its nutrition is impaired. This condition has been occasionally observed after extensive operations for varicocele when the blood supply to the testicle has been unduly impaired, and after operations for undescended testicle in which the spermatic artery has been purposely severed in order to relieve tension and permit the testicle to be brought into the scrotum. These operations have been followed first by swelling and later by atrophy of the testicle. Hermann B. Gessner, of New Orleans, in experiments in which he severed the spermatic artery in young dogs, usually found the testicle swollen a few days after the operation and later atrophied. There was no gangrene, but an eventual decrease of the epithelial parenchyma of the testicle occurred with an increase of connective tissue.

FIG. 15.—Miss E. R. Connective tissue from a scar on the breast. The scar was moderately broad, covered with normal epidermis, but was not contracted. (X 60.)

2—(e) Another interesting predisposing cause of cicatricial contraction is the absence of resistance of some tissues to certain normal secretions or excretions. This has been shown in attempts to repair the common bile duct. In a series of experiments in which I attempted to repair the common duct in a dog by transplanting a segment of everted vein, it was found that there was marked inflammatory infiltration of the transplanted vein with subsequent contraction and complete occlusion if the dog lived several months. This

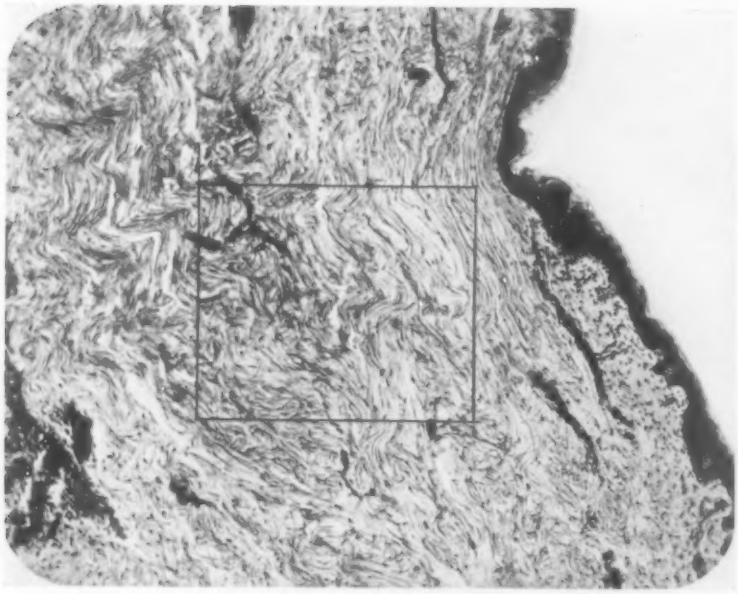

FIG. 16.—Mrs. W. E. G. Non-contracting scar from the abdomen. Note the apparently normal epidermis and the wavy connective tissue. (X 66.)

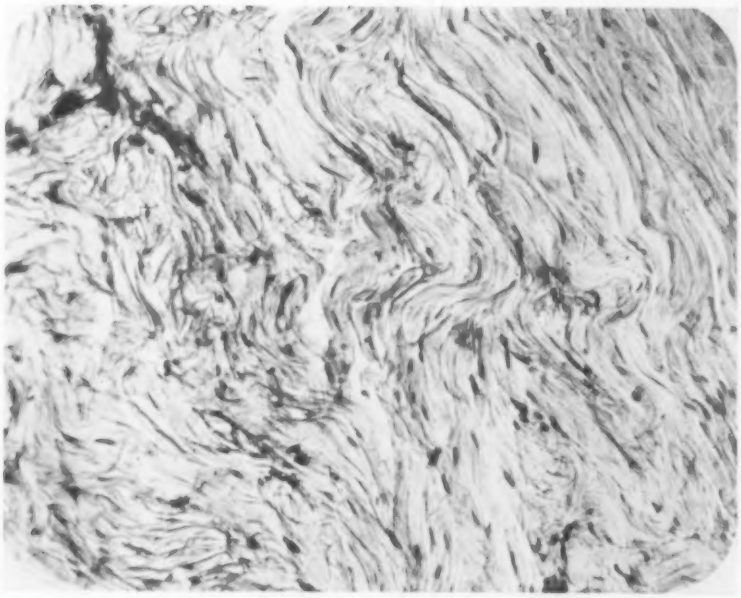

FIG. 17.—Mrs. W. E. G. Higher power view of the connective tissue shown in the preceding photomicrograph. The fibres of the connective tissue are fine, lace-like, but rather dense. (X 150.)

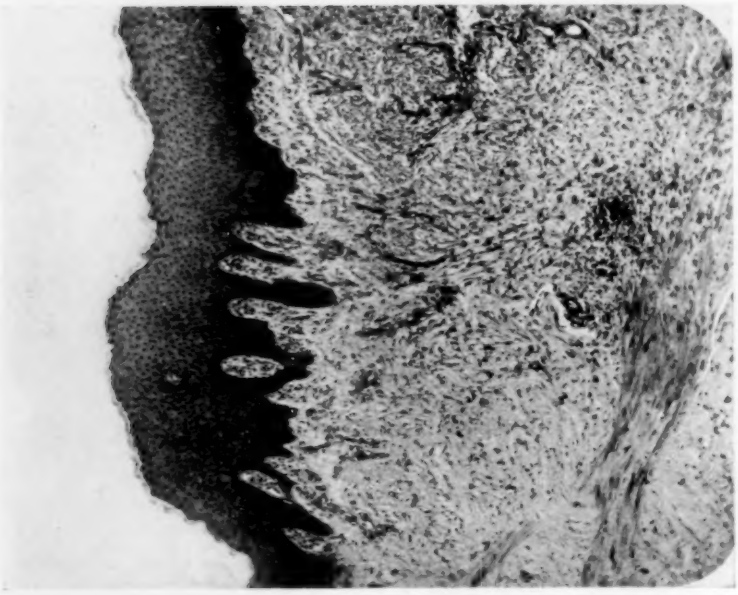

FIG. 19.—Dr. W. H. S. Photomicrograph of scar resulting from X-ray burn. The epidermis is thicker and tends to grow down into the tissue more than in the other scars shown, which resulted from a burn or trauma. The scar tissue beneath the epidermis is moderately dense with considerable leukocytic infiltration. (X 60.)

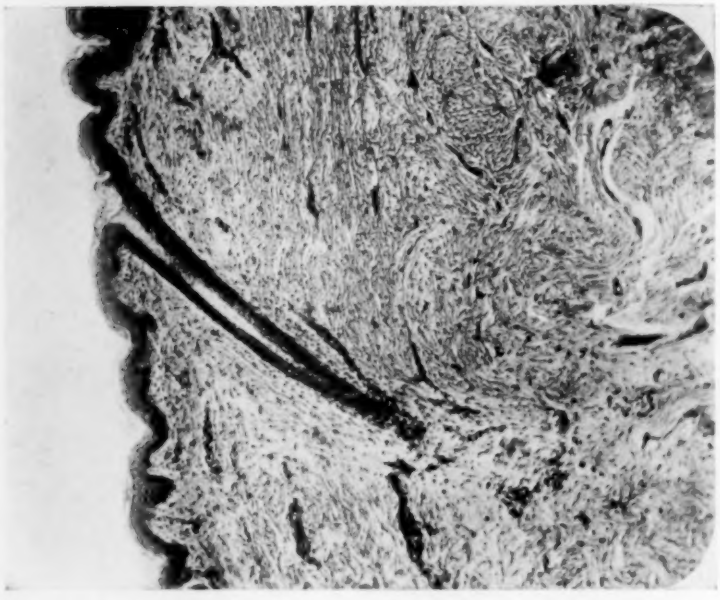

FIG. 18.—Mrs. W. E. G. Non-contracting scar of the abdomen. The union of the scar on the left with normal skin on the right is shown. The epidermis over the scar appears identical with that over the normal skin. Near the middle of the photomicrograph is a hair follicle. (X 60.)

occurred regularly in the dogs that survived. Histologic examination of the transplant showed that the portion nearest the bile, the internal layer, was always deeply infiltrated with round cells while the outer coats were but slightly affected (Figs. 22, 23, 24 and 25). The lack of local resistance to a foreign environment is illustrated in the occurrence of jejunal ulcer after gastro-enterostomy with an open pylorus. Mann and Williamson have reproduced in a dog a typical peptic ulcer by anastomosing the jejunum to the pyloric end of the stomach after diverting the alkaline duodenal contents. In many instances a peptic ulcer was formed where the mucosa of the jejunum was exposed to the gastric juice without the protection of the alkaline contents of the duodenum. The irritation of the skin of the abdomen by the discharge from fecal fistula, especially a fistula high in the jejunum, shows the poor resistance of the normal skin of the abdomen to the normal jejunal contents, even though the skin may resist traumas that the soft velvety mucous lining of the jejunum could not withstand. In the reconstruction of any viscus we should always take into consideration this phenomenon of the adaptation of tissues to

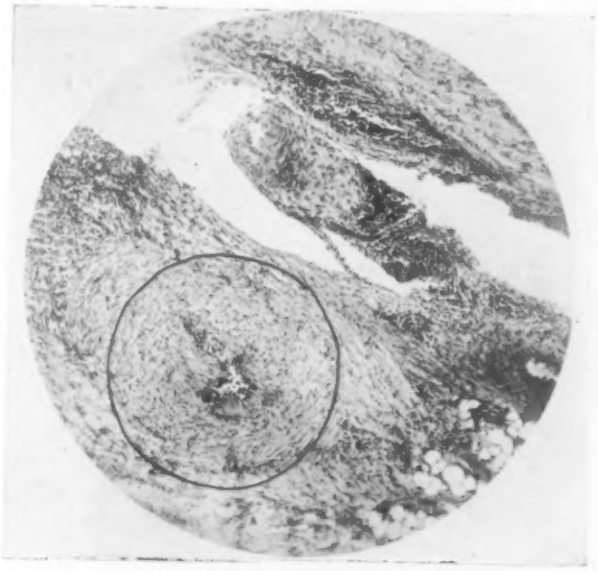

FIG. 20.—Dr. W. H. S. Photomicrograph of a blood-vessel from the scar tissue just beneath that shown in the previous figure. Through the upper portion of the tissue there is an artifact caused by the section pulling apart when it was cut. (X 60.)

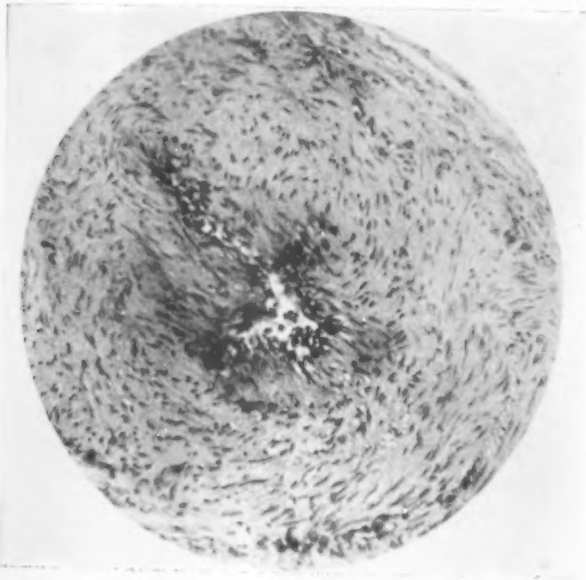

FIG. 21.—Dr. W. H. S. Higher power view of the blood-vessel shown in the preceding figure. The lumen is almost occluded, apparently by growth of the intima. There are faint outlines of what seems to be the inner elastic membrane. (X 150.)

their environment. No matter how neatly the suturing is done, if the transplanted tissue has not some biologic relationship to the region in which it is placed and if it has not resistance to the secretions from the viscus to which it is transplanted, there will be marked reaction and consequently great scar tissue formation and contraction. This is true not only of ordinary secretions, but to some extent of infection. Wounds in the perineum, for example, as from perineal prostatectomy, which must of necessity be exposed to infection from fæces, usually heal primarily and without undue cicatricial contraction, whereas if a small fraction of the fecal matter which must occasionally contaminate peritoneal wounds be transplanted to a wound in the suprapubic region or elsewhere high up in the body, severe infection would result. It is not uncommon for bone in a fracture of the jawbone, either complete from severe trauma or partial as from extraction of a tooth, to be exposed to the secretions of the mouth, and yet often but little if any infection occurs. In a compound fracture of the leg or arm, a similar exposure to the saliva and bacteria from the mouth would commonly result in sepsis.

FIG. 22.—Section from portion of a vein that was transplanted to fill a defect of the common bile duct of a dog. The vein was everted so that the internal surface of the transplant of vein consisted of the adventitia and lined the lumen of the transplant. This is shown on the right, whereas the external surface of the transplant on the left consists of intima. Note the marked infiltration of the internal lining of the transplant on the right. (X 30.) (From *Jour. Am. Med. Asso.*, Oct. 12, 1918, vol. lxxi, pp. 1188–1194.)

2—(f) The quantity of scar tissue seems to have much to do with contraction. The greatest contraction is usually along the central mass of the scar (Fig. 1). For this reason it seems probable that lack of nutrition to the scar tissue causes some shrinkage of the cells which may tend to promote contraction. Occasionally there is found a narrow strong band of contraction. This is doubtless due to the survival from an original greater mass of scar tissue of the central portion which had become so well organized that, even when better nourishment caused absorption of some of the scar, the well-organized central portion remained.

SUMMARY

(1) Cicatricial contraction is due to scar tissue, and covering the surface of a wound with epithelium alone does not prevent contraction except so far as it prevents infection or unnecessary trauma to a raw surface.

(2) The cicatricial contraction following X-ray or radium burns differs from other scars, in that the deeply penetrating rays cause an overgrowth of vascular endothelium which partially or completely obliterates the blood-vessels and makes a greater degree of ischæmia.

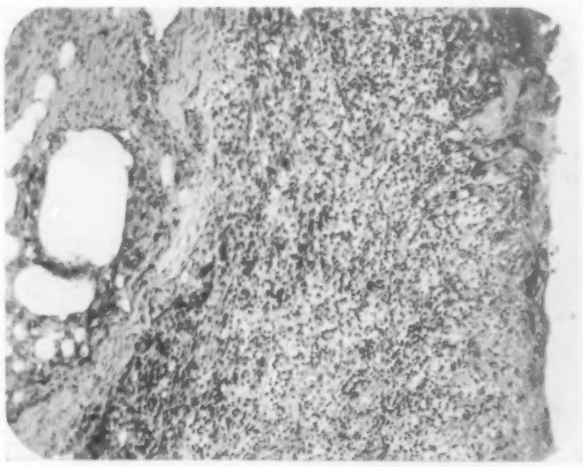

FIG. 23.—Higher power view of internal surface of transplanted vein shown in the preceding figure. Note the marked infiltration of the adventitia with small round cells. (X 125.) (From *Jour. Am. Med. Asso.*, Oct. 12, 1918, vol. lxxi, pp. 1188–1194.)

(3) There is a biologic resistance possessed by different tissues of the body to the normal secretions or excretions of their environment, so that in transplanting tissue this must be taken into consideration.

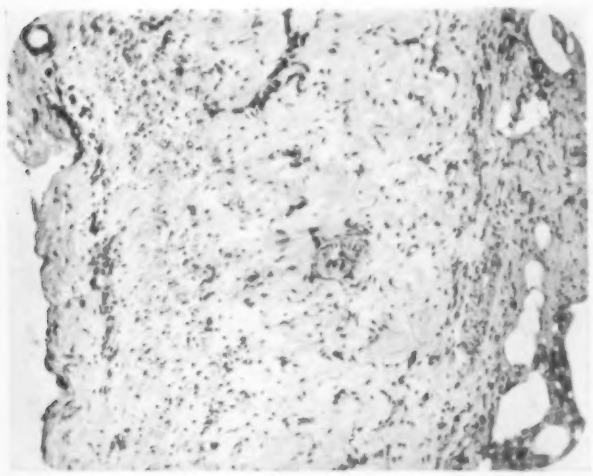

FIG. 24.—Photomicrograph of the outer wall of transplanted vein shown in Fig. 22, corresponding with the everted intima and a portion of the media of the vein. This represents the tissue on the left side of Fig. 22. This tissue seems well preserved and contains but little inflammatory products when compared with the portion of the transplanted vein which was bathed in bile. (X 125.) (From *Jour. Am. Med. Asso.*, Oct. 12, 1918, vol. lxxi, pp. 1188–1194.)

(4) Certain regions of the body, possibly because of some inherent quality, or possibly because of mechanical conditions which retard complete extension, are more prone to scar tissue contraction than other regions.

(5) As scar tissue is a lowly tissue that can survive on less nutrition and under harder conditions than other more highly differentiated tissues, it seems essential in avoiding cicatricial contraction not only to prevent the irritating effects of frequent injuries or of toxic substances, but to provide

a blood supply so that the higher tissues may survive and not be overwhelmed by scar tissue.

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FIG. 25.—Photomicrograph of the junction of a transplanted vein at the stump of the common duct (A, A.) In these experiments a segment of the everted vein was used to reconstruct the defect in the common bile duct of a dog. This specimen was removed twenty-three days after operation. The normal duct tissue is on the right and the transplant is on the left. The junction is shown by arrows (A, A.) The columnar epithelium at B has partly grown over the transplant, but its attachment was slight and was partly broken while making the section. (X 30.) (From *Jour. Am. Med. Asso.*, Oct. 12, 1918, vol. lxxi, pp. 1188–1194.)

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THE ART AND SCIENCE OF PLASTIC SURGERY*

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Introduction.—It is a significant fact and one which is very gratifying to me to have plastic surgery deemed of sufficient importance to be chosen by the American Surgical Association as the topic for a symposium, as this means that this branch of surgery has assumed its legitimate position. The titles of the papers to be read in the symposium to-day give some indication of the scope of the work, but I feel that it may not be amiss for me to discuss the subject as a whole rather than take up any particular phase, as during the last twenty years, I have been actively interested in the development of plastic surgery in this country, and have possibly had something to do with placing it upon its present status as a definite sub-division of general surgery.

The science of plastic surgery is the organized knowledge of the fundamental principles involved in the transplantation and shifting of tissues, and the clear understanding of what can be accomplished in this work. The art of plastic surgery is the application of this knowledge and the actual manipulative reconstruction. Bulwer-Lytton says that "art and science have their meeting point in method," and this is especially true in plastic surgery.

What is plastic surgery? This is a question, which is frequently asked and is almost as frequently incorrectly answered, as there is a great deal of misapprehension as to its scope and the possibilities of the work.

Plastic surgery is that branch of general surgery which is distinctly formative or restorative. It deals with the reconstruction of injured, deformed or lost parts all over the body; with the reëstablishment of function and incidentally with the improvement of appearance. Is plastic surgery anything more than surgery of the skin and adjoining mucous membranes? Most emphatically, yes; in fact, a great deal of the work is of a major character. While in many instances, the lesions include only the skin and adjacent soft parts, frequently the deeper tissues are involved and often the supporting frame work.

Development.—There are still many who wrongly believe that plastic surgery was entirely a development of the World War and that nothing had ever been previously done in plastic or reconstructive work.

The truth is that plastic operations were described in the earliest Indian and Egyptian records. Furthermore, plastic work was apparently well known in the early part of the Christian era. Then for many years the art seems to have been lost, at least to European surgeons, until about the middle of the fifteenth century when a Sicilian surgeon is said to have restored a lost nose by using a flap from the arm.

*Read before the American Surgical Association, May 24, 1926.

The first book on plastic surgery was published in 1597 by Gaspar Tagliacozzi and in it he described several operations, but gave special prominence to his method of rhinoplasty in which he used a pedunculated flap from the arm. In the course of a few years, this work was forgotten and it was not until the beginning of the 19th century that real interest was taken in plastic surgery by the foremost surgeons. During the first half of the 19th century, great strides were made in evolving principles and working out operative procedures. Some of the most distinguished surgeons of that time are known to-day only by the plastic operations, which have their names. The transplantation of skin and other tissues was a development of the latter part of the century.

Most of the fundamental ideas on which are based the majority of the plastic operations used to-day were worked out during the 19th century, some of them more than one hundred years ago.

Before the World War such men as Morestin, Nélaton, Ombrédanne, put France, in plastic surgery, far ahead of other European nations. In Germany, Lexer was preëminent in plastic work and created much interest in the subject. In England, apparently no one of note was interested, while in other European countries, except for certain surgeons who specialized in operations on noses, eyelids or lips and palates, there were no outstanding figures.

In the United States every general surgeon was doing plastic work as it came along in his service. No one was specializing in this subject and none of the busy surgeons had time or inclination to delve deeper into it.

About twenty years ago, Doctor Finney knowing of my interest in the subject advised me to concentrate on this work. As I became more and more familiar with the scope of plastic surgery, I found that the literature, which dated from the earliest times, was very widely scattered and that no attempt had been made to gather the threads together and coördinate the different branches of the subject. Moreover, it had apparently not occurred to anyone that the field was large enough or important enough to become a separate sub-division of general surgery. In fact, the idea of combining the plastic problems of the entire body as far as I could find out had not previously been thought of. I was speedily convinced of the importance of plastic surgery and soon saw the necessity of its development into a sub-division of general surgery. This work was well under way before the World War began.

Many of you are unaware of the bitter opposition which developed when the suggestion was brought forward that plastic surgery be made into a definite sub-division. It is an interesting story which I will not take up at this time. I am glad to say that at the Johns Hopkins Hospital the matter has finally been straightened out and plastic surgery is now on a firm basis.

There is no question but that the war stimulated general interest in the subject, but as a matter of fact, little advance was made in the principles of plastic surgery, although the very large number of cases available made it possible to standardize and improve operative procedures in certain groups of facial injuries.

With few exceptions, the group of men assigned to plastic work during

the World War were those who had previously confined their practice to eye, ear, nose or throat surgery, or to dentistry, and few had had a general surgical training. The majority of them, I venture to say, had never done a plastic operation and were ignorant of the literature of the subject. In consequence, much time was wasted and much suffering was endured by the wounded, but gradually satisfactory methods were developed, which were based largely on the elimination of procedures which had failed. Some of these methods have since been reported as new, which are either modifications of well known procedures or rediscoveries of methods long familiar to the student of plastic surgery.

It is a well recognized fact that few general surgeons can do plastic work well, so it is becoming more and more the custom to refer such cases to those especially trained along this line. If the best interest of the patient is taken into consideration, this is a logical move and is a development similar to what happened when genito-urinary surgery, orthopædic surgery and neurological surgery were split from the general surgical tree. No one can gainsay that in these conditions better treatment is given patients by trained specialists in these sub-branches of surgery than when they are looked after by the general surgical service, and this is particularly true when dealing with plastic cases.

There is no division of surgery which does not call on the plastic surgeon at one time or another as problems arise, and I have found that it is a much needed development.

In a paper published several years ago, I used the term, general plastic surgeon, to distinguish the few surgeons who have given special attention to plastic problems of the entire body from those who have confined their plastic work to facial reconstruction of one sort or another. So when I speak of a plastic surgeon, I mean a general plastic surgeon, as I do not regard a man who confines his work, say to noses or eyelids or palates or even to the face alone as fully qualified except in a limited field.

Scope.—To the layman, the face is the only field for this work, and strange as it may seem, the same idea is often held by the profession. The limitation of plastic surgery during the World War by military regulation, to maxillo-facial reconstruction, has undoubtedly had much to do with the erroneous and wide-spread impression that plastic surgery is entirely confined to the face. Unquestionably this is a very important branch of the subject, but plastic work on the trunk and extremities is equally important. The principles are the same but the problems are entirely different. I should again like to emphasize the point that plastic surgery should be visualized as a whole and not be thought of from the viewpoint of any one of its sub-divisions.

The only way to educate the laity as to the possibilities of plastic surgery and to warn them of the danger of such things as the injection of paraffin under the skin, which is so frequently done by cosmetic surgeons, is first to educate the medical profession so that they really know what true plastic

surgery is. When this has been accomplished, then the task of educating the public will be simpler.

Plastic Versus Cosmetic Surgery.—Plastic surgery is confused in the minds of many with the work done in beauty parlors. Without question, plastic or reconstructive surgery is absolutely distinct and separate from what is known as cosmetic or decorative surgery. As a matter of fact, a very small part of real plastic surgery is done for cosmetic or decorative reasons only. All plastic surgeons have to do cosmetic work occasionally, usually in the course of other procedures, but do any of you happen to know of a trained surgeon of standing in the profession, who has become a decorative surgeon?

The so-called "plastic surgeons," who are usually well advertised, and who are really "beauty doctors" should be termed cosmetic or decorative surgeons, as few of them have even a glimmer of the principles of legitimate plastic surgery, and none of them are interested in the real problems of the work. When possible, I avoid even the use of the word cosmetic † in my reports, as I feel that it has little place in true plastic surgery, whose main object is the correction of actual deformities.

Personally, I have never cared to do cosmetic surgery, as its aims do not coincide with my conception of what true plastic surgery should be. I am sure that Doctor Lewis agrees with me when I say that at the Johns Hopkins Hospital we are not interested in either the development or performance of cosmetic surgery.

The question is often asked, what is the ethical difference between doing an abdominal operation and removing wrinkles from a sagging face? The answer is simple, the abdominal operation is necessary to the health of the patient, the operation for removal of wrinkles is unessential and is simply decorative surgery, so these conditions cannot be exactly compared.

However, there is a group of patients who desire face lifting, or some similar procedure done, who have a definite psychosis, and at times the plastic surgeon is called upon to operate in order to relieve the mental condition. These patients are seldom satisfied, however good the result may be, but nevertheless they have to be taken care of, as to them the unessential face operation means more than the relief of a severe abdominal condition.

Training.—I feel very strongly that it is imperative for the surgeon who expects to do plastic and reconstructive work to have a thorough general surgical training, including a good working knowledge of anatomy and pathology before attempting to specialize in this branch.

The plastic surgeon should be more than a skillful operator. He should know how to care for large unhealed defects and how to prepare them for contemplated plastic work, although it has been said by those who should know

† Cosmetic, definition of, from the Century Dictionary: Pertaining to beauty; beautifying; improving beauty, particularly the beauty of the complexion * * * Any preparation that renders the skin soft, pure, and white or helps or professes to be able to help to beautify or improve the complexion * * * The art of anointing or decorating the human body, as with toilet preparations.

better, that the treatment of wounds is a waste of time for the plastic surgeon and is out of his field. He should understand the proper preparation of scar infiltrated tissues and the utilization of such tissues. Thorough familiarity with the free transplantation of skin, mucous membrane, fat, fascia, bone and cartilage is essential, as all of these tissues are constantly utilized in reconstructive work. The principles of tissue shifting and of the use of pedunculated flaps must be understood; also the possibilities of combinations with the above-mentioned free transplants.

The plastic surgeon has a point of view which is essentially different from, say that of the man doing general surgery, as he has to deal almost entirely with defects and deformities of one sort or another, and in many instances his work is with tissues poorly nourished and infiltrated with scar. His operative methods also differ materially in many ways from those in common use in general surgery. He is accustomed to undertake cases which seem entirely beyond help and which have been refused or botched by others.

It is essential that he have an aptitude for the work. He should understand the use of local anæsthesia. He should have sound surgical judgment and be a good operator. He should handle tissues with great consideration. The ability to study out and diagnose the condition in each case is necessary, as there are seldom two alike. An artistic sense is useful. He should know how to make haste slowly and not be tempted to do too much at a time or to do it before the tissues are ready. He should understand the process of gradual building up, the entire series of operations being planned with regard to the ultimate result rather than the immediate relief of the condition. He should also know when to act swiftly. He should be skilled in post-operative care, as the success or failure of many plastic procedures depends on proper treatment after the patient is back in the ward. He should understand the surgical handling of children. He should have a knowledge of the use of prosthetic appliances and be familiar with the ordinary surgery of the nose, throat and mouth. In addition to his other qualifications he must have originality and infinite patience and must understand the psychology of patients under treatment over long periods of time. He must be an optimist, something of an idealist and must have a far vision. Finally, he should have cheerfulness and a full measure of sympathy of which he must give freely.

Diagnosis.—Inasmuch as many of the lesions dealt with in plastic surgery can be seen, at least in part, the type of diagnostic skill required by the plastic surgeon is not the same as that which is necessary, for example, to determine obscure abdominal or brain lesions. Nevertheless, accurate diagnosis is of equal importance in plastic surgery, as perfect understanding of the extent of destruction or change in form in the structures involved is essential as well as the realization of the physical and mental effect of the lesion. In many instances this is far less simple to determine than it would seem to one unfamiliar with the difficulties involved and requires very circumspect handling, much thought and the aid of models, Röntgen-rays and many of the routine diagnostic methods. The keenest surgical judgment is often neces-

sary to determine what should be done and how to do it; whether or not a plastic procedure should be finished at one operation; how far to go in the initial operation, and when to follow with the secondary procedures.

Results.—The results obtained in many of the deformities corrected are little short of marvellous, but where there has been extensive destruction of tissue with much surrounding scar infiltration, it is rather far-fetched to claim that the part can be made to look exactly like it was before the accident. However, the improvement obtained in the majority of cases is well worth striving for.

Research.—The field of research in plastic problems is a large one, and while very little stress has been laid on this aspect of the matter, considerable progress has already been made, and we are endeavoring to advance the knowledge of the subject along rational experimental lines. Much of this work should be done in the experimental laboratories, but there are important research problems to be worked out in the operating rooms and wards, which also require the trained investigator. For example, I might mention that there is still much to be learned about the utilization of transplanted tissues and their fate; the processes of repair; the chemistry of healing; the practical use of tissue cultures; the causes of congenital malformations, and so on *ad infinitum.*

The literature of plastic surgery is increasing very rapidly and numerous articles are appearing in many journals. Might it not be worth while to consider the publication of a special journal devoted to plastic surgery in its various phases similar to those of other surgical sub-divisions?

What is the financial return which may be expected by a well trained surgeon, who limits his work to general plastic surgery? is a question which is often asked by young men who are contemplating taking up this branch of surgery. Not as much to be sure as is made by a very popular general surgeon, but enough for all practical purposes. It is impossible for any patient to pay in dollars and cents for the services rendered in some of the long drawn out cases, but I can say that there is a personal satisfaction in the successful outcome of this work, which I do not think any other division of surgery gives. I believe that service to others is the watchword in legitimate plastic surgery even more than in other branches of surgery. It is true that the deformities dealt with by the plastic surgeon are found more frequently among those not blessed with a superabundance of this world's goods, but if these patients can be put back to making their living and can go about without attracting undue attention on account of their disfigurement, then something really worth while has been accomplished.

If one eliminates the ideals of ethical plastic surgery and goes into what is known as cosmetic or decorative surgery, then the financial picture changes. The incomes made by some of these men, who are mostly quacks, are said to be enormous, as the individuals who want face lifting and similar operations done, usually have money to pay for it, and as a matter of fact, I am told, have to pay for it in advance or it is not done.

Teaching.—The teaching of plastic surgery is essentially post-graduate. The medical student should be given enough to familiarize him with the scope of the subject and he should know in a general way what can be done in this field. In this branch as in all others, the real training only begins after graduation, and so with the hearty coöperation of Doctor Lewis, we are beginning this Fall to combine a general surgical training with special attention to general plastic surgery. An assistant resident, who is interested, will be assigned to the work and will be carried through until proficient. This plan seems the best so far developed. We are fortunate at the Johns Hopkins Medical School in having two fellowships in plastic surgery granted by the General Education Board, which are assigned to carefully picked graduates. Their research training is carried on in the Hunterian Laboratory and their clinical experience is obtained in the plastic surgery dispensary, in the wards and operating rooms. The great need with us at present is ward beds, but the prospects for the future are promising, and we feel that in a comparatively short time, this lack will be supplied. Elsewhere, as far as I can ascertain, there has been as yet no systematic attempt to develop the teaching of general plastic surgery.

Present Status of Plastic Surgery.—The present status of those doing plastic surgery in the United States and also in Europe is about as follows: A few well trained surgeons, who have given special attention to plastic surgery of the entire body, who can be classed as general plastic surgeons; those general surgeons who have a special talent for the work, but ordinarily have not the time or inclination to give to it; a larger group, war trained, who specialize in plastic surgery of the face, and some of them are doing splendid work; then a mixed group, who confine their plastic surgery to one type of operative work, as for instance the nose, the eyelids, congenital clefts of the lip and palate. Then the group of surgeons without special talent or knowledge who do plastic operations as they do everything else that comes under their hand. Those, who specialize in cosmetic or decorative surgery, should not in my opinion be considered plastic surgeons.

The question of taking up plastic surgery as a career is a very different matter to-day from what it was twenty years ago, when I essayed to do it. To begin with, the opposition to its full development is now small; it is an established branch; there are a number of excellent books available; there are better facilities for seeing good operative plastic work; there is a great popular and professional interest in the subject. It is possible to get instruction; there are certain fellowships available to suitable men desiring to perfect themselves. There is an association of plastic and oral surgeons. The nomenclature is being simplified and standardized. None of these advantages were at hand twenty years ago.

After this brief outline of the subject the question arises, is the field of plastic surgery large enough and interesting enough to justify a trained surgeon in devoting his entire time to it?

I am convinced that it is. As the years go on, I find that the field seems

to grow wider and the work becomes more useful in the scheme of a general surgical department with its various sub-divisions.

I believe that very soon there will be created in every large surgical clinic a sub-division of plastic and reconstructive surgery, such as we now have at the Johns Hopkins Hospital, under men especially fitted and trained for this work.

I am now confidently looking forward to the time when this division can send out men adequately trained in general plastic surgery from the standpoint of the laboratory, the wards and the operating rooms, and to this I hope to be able to add some common sense and a good deal of the milk of human kindness.

CONGENITAL CLEFT LIP AND PALATE*

A MUSCLE THEORY REPAIR OF THE LIP CLEFT

By Harry P. Ritchie, M.D.
of St. Paul, Minn.

Repair of a lip cleft on the muscle theory is based on a general surgical operation; the union of a cleft sphincter muscle. It is not my purpose to propose a new method of closure but to discuss principles and procedures involved.

The terms here used are those of the classification which John Staige Davis and I offered a few years past. The suggestion was made of a very

Fig. 1.—Two hare lip operations are here compared. Primary results were entirely satisfactory. One grows beautifully, the other with deformity. My opinion is that in one the tissues were replaced in a way normal to that baby, in the other the effort failed.

simple and rational change in the concept of the general subject. The literature has been built upon the original idea: a dual point of view, indicated by the title "Hare Lip and Cleft Palate." The change suggested is that the many problems be rediscussed upon the basis of a *series* of *congenital clefts*. The essential points of the plan are that the complete palate is resolved into its component parts and the term "hare lip," long recognized as an inapt if not misleading term, is erased. Each cleft is a result of failure in the same embryonal closure; no one to be emphasized over another except as it appears of more importance in a given case.

The proposal offers an opportunity of describing separately, the lip cleft, the alveolar process cleft, the hard palate cleft and the soft palate cleft, not only as to form, but what is of equal, even more importance, the degree of

* Read before the American Surgical Association, May 24, 1926.

the cleft. I believe that many problems now under rigorous debate can be settled on the basis of degree. I am impressed by the observation that controversy as to procedure in this surgical field is often caused by a loose and indirect terminology, and that the use of common descriptive terms would greatly obviate this tendency. Thus by our plan of record, the arrangement of the tissues may be exactly recorded in direct, positive and unvarying terms.

It requires only a cursory examination to prove that each cleft involves different tissues which require consideration of appropriate surgical principles.

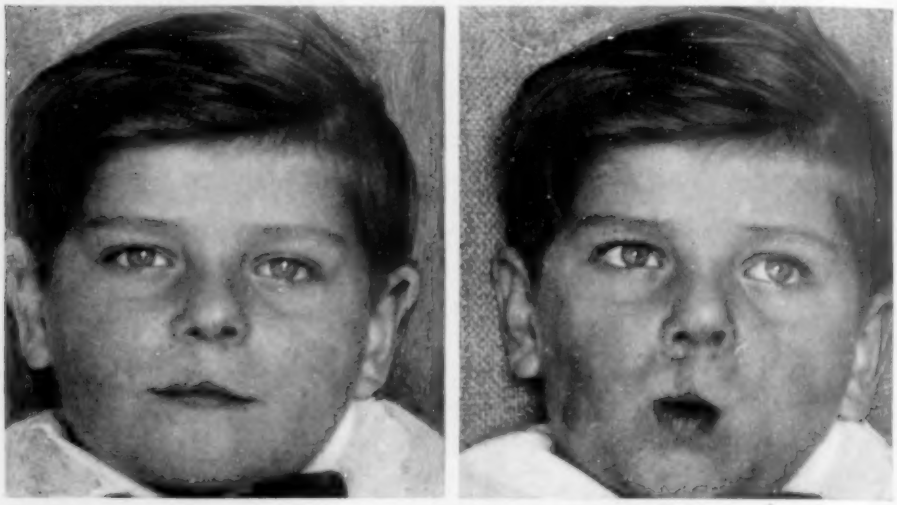

FIG. 2.—There are several cases with splendid cosmetic results, which show varying degrees of distortion on motion of the lip. This is my principal reason for approaching the problem of lip repair from the angle of function.

The procedure in closing each cleft must conform to the character of the tissues and since these vary, the technical phase must be approached on the plan of separate clefts, the methods of repair to be determined independently.

The purely surgical problem, judgment as to time, combination and sequence of operations, now becomes widely broadened. The hare lip and cleft palate idea is too narrow. It fosters the use of special routine methods for the repair of either one or the other. The series proposal gives to this field of the viewpoint of general surgery: selection of procedures to fit the case.

The Theory.—Of the series, the lip cleft has always been recognized as a problem differing from those of the palate. The repair has been approached as a special hare lip operation. There have been many suggestions as to straight, curved or angulated lines of incisions, cross-cuts, flaps, tissues mobilized out of position to guard against stitch tension, tissues reflected out of position to prevent contracture and many follow-up plans of support. The purpose of the effort is to make the lip look as normal as possible, thus elevating in importance the cosmetic result. At least that is what I have been trying to do. If it is a unilateral cleft, I try to make the defective side look like the normal; if a bilateral, to make the two look alike.

In the few years of my interest in this field of surgery I have increasingly felt the need of a more positive purpose in the operation, a motive more direct than looks. The idea occurred that if the problem was studied from the aspect of function, a greater assurance of a satisfactory, possibly perfect, end result would follow. So I offer suggestions for the repair of the lip based on the idea that restoration of normal function is the primary object,

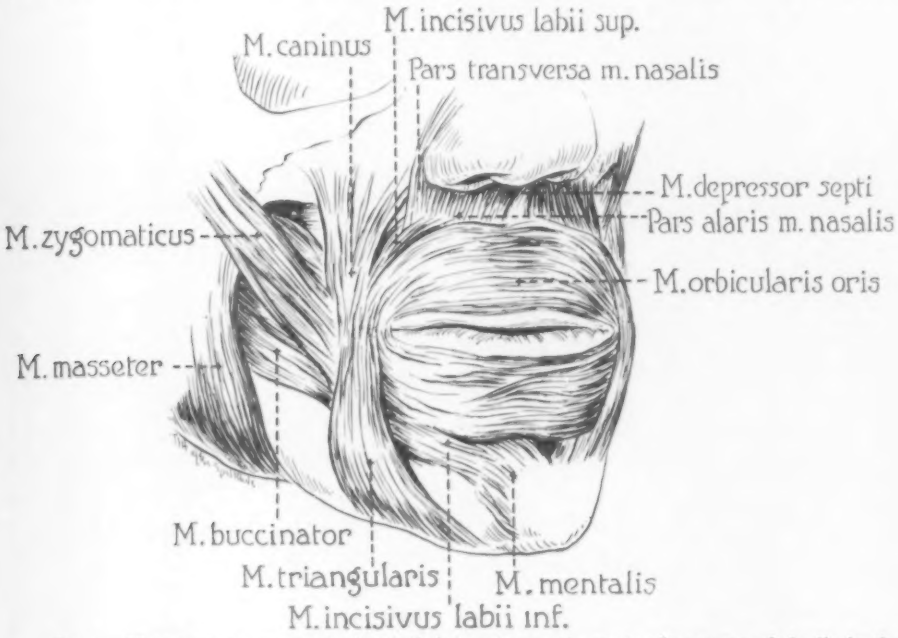

FIG. 3.—The muscle-theory repair of cleft lip is based upon the study of anatomy of the lip in the adult. The active tissue in this structure is the obicularis oris muscle. It is so arranged as to permit of special motions, but its composite action is that of a sphincter; puckering the tissues as in whistling. By reason of its position it must be further considered. Radiating from it are several muscles noted in the drawing. Thus it must be considered the key ring of the expression muscles of the face and is the medium of contact between the right and left groups.

believing that proper cosmetic result will immediately follow the operation or can be accomplished at a later date.

The variation in my hare lip operations is too wide, ranging from beautiful results, to very unsatisfactory ones. Cases which started well are not growing normally, cases starting poorly are improving each year. There are quite a number of children with splendid cosmetic results, who show definite distortion of the lip on motion, both in speech and expression. (Figs. 1 and 2.)

Some explanation of this variation other than operative failure must be made. The question naturally arose whether in the good lips I had not replaced the cleft tissues in a way normal to that baby. This thought led to the question whether there was not some characteristic arrangement in each baby's lip that would lead to the replacement of tissues out of contact in a way normal to that individual. This appears as a proposition leading to an ideal. But attention is called to the word "individual." If one goes through a babies' ward, critically records the various contours of nostrils, the long,

short, thin, thick lips, with varying degrees of mucous membrane eversion, then our present plan of repair, a set procedure plus the personal interpretation of the operator, must yield in the end some degree of variation. Though cases appear similar at this early age, no one can visualize their aspect in adult life. So many writers have called attention to the fact that it is not the immediate but the end result that will prove our work. In other words, the time element must enter argument and effort. Proper repair will depend upon normal replacement plus the years of growth.

FIG. 4.—If the premises stated in Fig. 3 are correct it may be argued and I believe concluded that the purpose in lip repair is the exact apposition of this contractile tissue. The above picture is worthy of close study because it represents the natural plan and procedure. This boy is a pre-alveolar cleft, the lip being the only one of the series in this group. Nature failed only at the mucous membrane body of the muscle. But in making contact, the suture line on the skin was left. On the lip the line hugs the left border of the philtrum and continues up into the floor of the nostril. I interpret this case as a wonderful model for surgical repair and indicates lateral approximation of the muscle.

Therefore an answer to the ideal proposition must be sought in the study of the lip in the adult. This reveals that the body of the lip is mainly composed of a structure called the obicularis oris muscle. All other tissues are mere coverings for this muscle. It is the only active tissue in the lip and being muscle conforms to the behavior of similar tissue elsewhere in the body, hypertrophies on use, atrophies on disuse, and normal action depends upon proper origin and attachment. As a muscle body it varies in size, distribution, power and function as do all muscles in different individuals. Intrinsically it is a sphincter, at least in its lower fibres, puckering the tissues as in the act of whistling. It is important to remember that its use is an essential in proper speech. But by its position and association it must be further considered. Radiating from it or into it are all the muscles of the face, a group which may be called expression muscles; the zygomaticus, ala depressors, buccinator, etc. Every single or group action of these indirectly affects the sphincter, any action of which must work the reverse. In other words, the obicularis oris is not only a pucker muscle, but is in effect the key ring of all the expression muscles of the face. It is the main medium of contact between the right and left facial groups. (Figs. 3 and 4.)

FIG. 5.—Under anæsthesia the outlines of the muscle are not evident except by some surface markings, nor is it visualized during dissection. It must be there because in the adult a powerful band is present. I thought if this tissue could be contracted its exact outlines could be determined.

The above is a statement of anatomical facts long known and repeatedly demonstrated. Carrying this established picture of the adult to the congenitally cleft lip it appears a reasonable conclusion that the motive in the repair of the lip is the exact approximation and union of the cleft body of this muscle. The opportunity for normal growth, the permanency of any

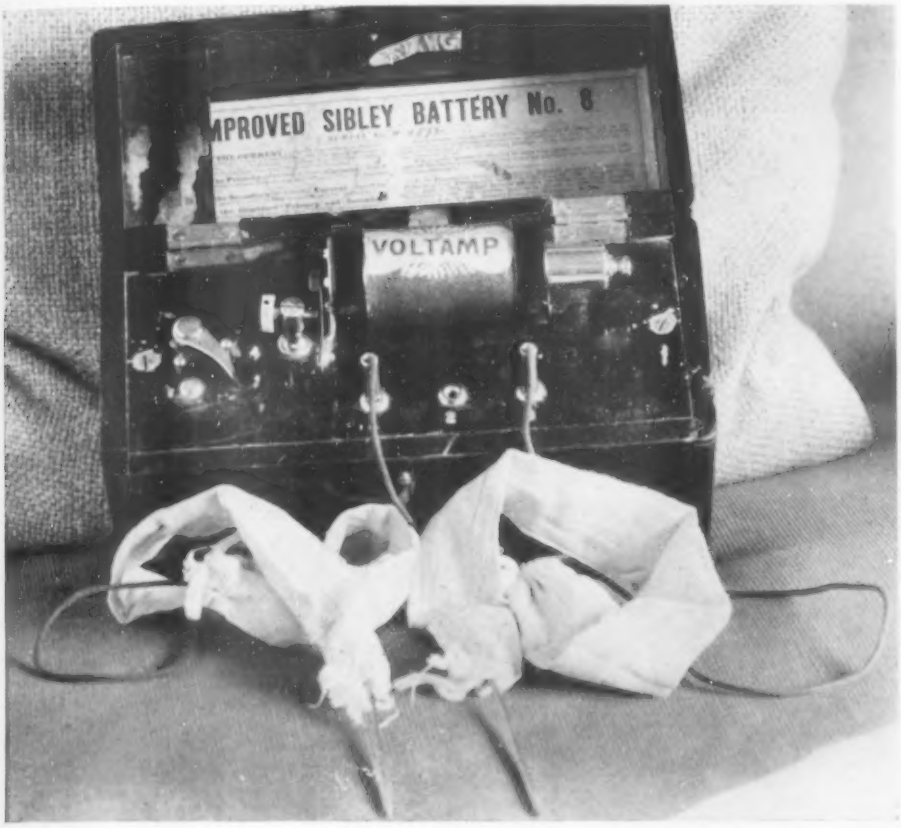

FIG. 6.—The agent used to contract the tissues at operation. This is a one dry-celled faradic battery prepared as stated in the paper.

associated plastic repair will depend upon the precision with which this is accomplished.

The Operation on Cleft Lip Unilateral.—That this problem has not been generally approached from the angle of function is due to the fact that in the sleeping inactive infant, the contractile quality of this tissue is not demonstrated, its outlines not shown except possibly by some surface markings, and during the dissection it is not visualized as muscle. But it must be there because in the adult the powerful band of the lip is present. (Fig. 5.)

The idea came that if it were possible to contract this tissue at operation, four cardinal points could be obtained; the upper and lower margins on each side, and that exact lateral approximation would then lead to the union in a way normal to that baby.

I remembered the muscle jiggling experiments of our laboratory days with the faradic current, combed the market to find a cheap one dry-celled battery. The therapeutic attachments were disconnected and two three-inch long copper wire points were made for the distal ends of the cords for muscle stimulation. The proximal cord ends are put in No. 1 and No. 3 holes of the battery, the rheostat pulled half-way out, thus obtaining an agent to contract this tissue and show its exact outlines. (Fig. 6.)

FIG. 7.—Under stimulation the muscle contracts to almost a right angle. Out on the mucous membrane the lower border is shown. This point is indicated by the knife point.

To clearly describe the steps of an operation is a most difficult effort. I have followed the scheme of steps as being the most direct and concise plan that I know.

Step One.—On the short side one copper wire point is placed at the angle of lip, the other near the cleft margin, both held firmly on to the mucous membrane and the switch swung on. Under stimulation the cleft muscle jumps up like a biceps under contraction and the usual curve of the lip contracts almost to a right angle. The cleft margin looks like a wall, the width of which is the thickness of the lip of that baby at the time of the operation. Out on the mucous membrane quite frequently a pit occurs, due in my opinion to contraction of the real sphincter fibres. A nick is made at this point to represent the lower margin of the contractile tissue. (Fig. 7.)

Step Two.—The lip is reflected backwards with a single tenaculum or a stay stitch and the points again applied. The muscle again contracts revealing the upper margin. In order to expose this border an incision is required which I believe varies in inclination and degree in different babies. I am uncertain how much of the skin is included in the cut but I feel sure that at least a nick should be made. (Fig. 8.)

Step Three.—The lip is allowed to fall into place. By means of a tenaculum or stay stitch the lip is stretched. The two points, one above on the skin, the other below on mucous membrane, are connected by a perfectly straight incision, taking a thin shaving of skin. (Fig. 9.)

Step Four.—While the lip is still on the stretch, by close and careful dissection the mucous membrane is dissected back as a flap, thus exposing the sphincter in perfect position for lateral approximation to the opposite side of the cleft.† (Fig. 9.)

Step Five.—The denuded lip is packed, pressure applied to the bleeding surfaces.

† At this point the ala should be brought forward to a level of the base of the columella. Whether the lip is a pre-alveolar cleft or an alveolar cleft, whether the process cleft is to be closed by the lip or has been closed by mechanical measures either immediately preceding the lip operation or at a remote period, the ala is quite constantly depressed and must be moved to a plane conforming laterally to the normal nostril. This should be done after the muscle is exposed because should it be attempted before denudation, the exact outlines of the obicularis and its normal relation to the underlying process may be lost.

Step Six.—The same procedures are used for the long side with two additions. The frenum is carefully preserved, as we are trying to make a normal lip. At the base of the columella, extending into the cleft nostril, is an epithelial structure which I have always used as the inner half of the floor of the nostril. Under contraction it is necessary to raise this reflection in order to fully expose the upper border of the muscle, proving that what I had done indirectly now becomes a direct step.

Step Seven.—A hook is fixed in the denuded muscle which is pulled out as is done in complete laceration of the perineum. A stitch is inserted exactly into the upper fibres

FIG. 8.—The lip is reflected upward and outward and the points of the battery again applied. This manœuvre develops a most important point, where the wing of the nose, the alveolar process and the muscle meet. To properly expose the latter an incision is required. This varies (in different babies) in length, depth and inclination. How much of the skin is involved in the cut I am uncertain but I am sure that a nick should be made.

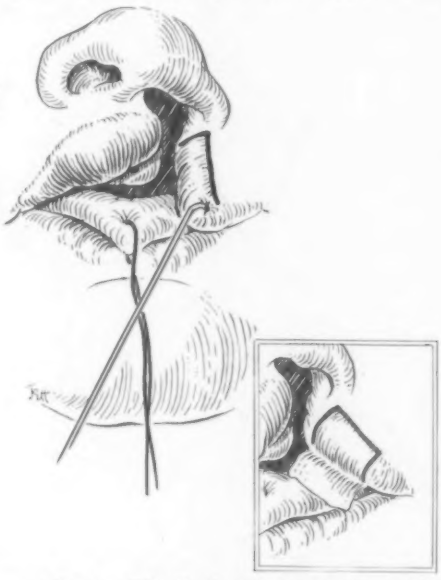

FIG. 9.—With the lip pulled out on the stretch, a perfectly straight line incision is made connecting the point on the skin above to the point on the mucous membrane below. While on the stretch the mucous membrane is carefully dissected backward, as a flap, as shown in the insert. This exposes the contractile tissue which was determined under contraction. The same procedure is followed on the other side.

of the short side, and across to the long side, another in the middle and a third in the lower sphincter group. All this for the purpose of apposing the cleft muscle from side to side without distortion of it in any way. As the top stitch is tightened the ala swings in to meet the epithelial reflection mentioned in Step Six. At this time any plastic work on the floor of the nostril and ala can be done. If the muscle theory holds, this should not be necessary, but I have so far found it advisable to at least make the raw margins more exact, but believe that as little plastic work on the nostril as possible, should be done. A lateral mattress stitch is then placed to make a floor to the nostril. This floor is a definite anatomical entity, observable in all normal individuals, but seldom mentioned in any of the hare lip operations. (Figs. 10 and 11.)

Then the skin stitches are placed and the muscle stitches tied underneath, thus accomplishing the principle of a two series suture line, which I believe is a most important procedure in all plastic repair of the face and neck.

The muscle stitch represented in the drawing is the vertical mattress which is a non-constricting, broadly apposing stitch and, therefore, applied to muscle tissue. These are placed in from the mucous membrane side. By so doing the best chance of completely grasping the muscle fibres is taken. I have thought of using the figure-of-eight stitch.

I have been using this stitch in the soft palate for three years or more with the greatest satisfaction. It has been of general use in my laparotomy wounds, breast flaps, etc., and is of great value because it combines approximation with a tension stitch and is indicated in the lip and soft palate because we have in both locations active tissue, which, once united, assumes some degree of contraction, and pull against mere coaptation stitches immediately begins. Lateral approximation of cleft contractile tissue without distortion or displacement, is the basic principle upon which the above plans are developed. (Fig. 12.)

The Median Cleft.—I have concentrated upon the unilateral cleft lip because in the study of incidence of form and degree, according to the above-mentioned classification, this condition occurs in about 70 per cent. of cases. It is a most frequent problem, not only in the alveolar cleft group, but in the group of pre-alveolar clefts. But there are included in this general question of the lip two other forms, namely, the median and bilateral. I have seen only one median lip cleft which, however, was so perfect that the frenum was symmetrically divided and attached to each of the cleft processes. I mention this because there was in this case no question of mobilization of tissues or any thought of rearrangement but only definite exact lateral union. This resulted of course in a perfectly natural lip. I report it because it is the best example of the principle of lip repair which I am endeavoring to promulgate, *i.e.*, lateral approximation of the muscle structure. (Fig. 14.)

FIG. 10.—Any mobilization of the ala should be done after the denudation of the short side. When this procedure is done, two surfaces appear that are equal in length and width, in perfect position for lateral union. I am unable to make them as perfect as shown, but that is my purpose. The stitch shown is most important and should include the very upper fibres of the muscle. It is this stitch that determines the degree of rotation of the ala.

The Bilateral Cleft.—To apply this effort to the bilateral cleft lip, difficulty is immediately encountered and can only be solved by answering several questions which I have raised and presented to several consultants. The first and most important of these from a surgical standpoint is the presence or absence of muscle structure in the prolabium. Dr. R. E. Scammon, Professor of Embryology at the University of Minnesota, thinks there is no muscle here unless it comes down from the frontalis, which is a long journey. I have been unable to demonstrate it with the battery in the complete cleft, but if one side is incomplete then contraction takes place. I have, in one case only, studied the removed rim of mucous membrane histologically, and this contained no muscle. If muscle is not in the prolabium of the bilateral cleft, how does it get there in the normal lip? Dr. J. E. Thompson, of Galveston, referred me to Keith's Embryology, where an explanation is made.

This refers to an embryonal movement of muscle in its distribution expressed by the word migration. Whether this is a proven fact or not, it offers the most rational explanation because in normal lips the contractile tissue is a band formed *underneath* the prolabium which becomes the philtrum. From a surgical viewpoint of normal repair, then, the obicularis oris is mesially cleft with equal groups of fibres on either side.

If the muscle theory holds, plans must be made to bring the cleft ends together in the midline on the mucous membrane side. It appears impossible

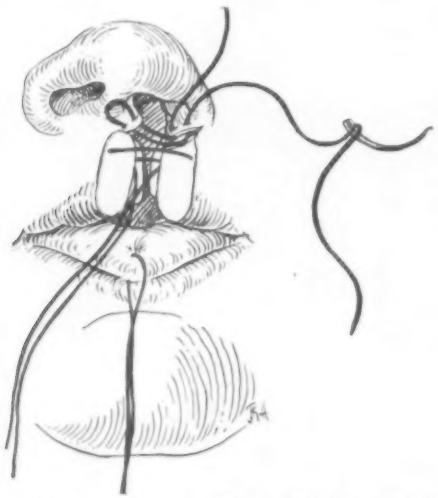

FIG. 11.—The top muscle stitch is pulled down, and a lateral mattress placed in the denuded area of the ala and the epithelial reflection at the base of the columella. This reflection is up in the nostril. In the drawing it looks as though it was upon the lip. In all adults, the floor of the nostril has a length and is nearly at right angles to the lip. Two other muscle stitches are placed, and the skin incision closed.

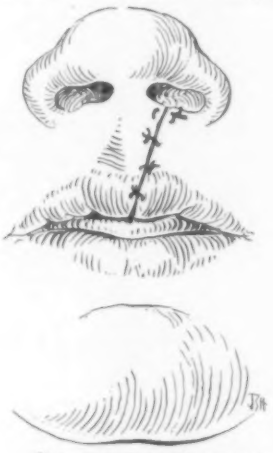

FIG. 12.—Lateral approximation of a cleft sphincter muscle is the expression I have used. I am not sure that this is correct. So many cases show an oblique suture line. It must be remembered that the obicularis oris is formed on a curve. A cleft on one side of the exact middle of the curve would be on an oblique plane. Possibly, end-to-end union of a cleft sphincter is more exact.

to unite the band mesially in its entirety, but it is an established fact that if a muscle is anchored to another structure and heals it will assume function in its new position. This may be made use of for the upper and middle section of the muscle which are sewn to the prolabium. In order to obtain real function, the sphincter, that is the lower group, must be approximated mesially and behind, thus building a lip long on the mucous membrane, while the length of the skin side is determined by the extent of the prolabium.

In support of these arguments I present illustrations of three cases: one, a primary effort; another, a secondary repair of a boy who had no power of expression in the lip until the muscle was found and mesially sewn together with the result shown in the picture taken two weeks following repair; a third, a man aged twenty-eight, lacking not only function of the lip, but all power of expression, assuming that blank, mournful look which so many cases of imperfect lip repair have. The picture of the adult appeals to me as most conclusive in support of the above arguments. Time and effort had so developed these groups of muscle tissue that they become

very evident on inspection. This lip was only a curtain. As soon as the muscle was approximated the whole outlook of this man's life was changed,

FIG. 13.—A group of cases of cleft lip unilateral showing results of repair based upon the muscle-theory. All of these cases look very well on front and side view. They are taken in position to show and in some of them exaggerate any deviation from the normal. Included are two of the worst results. They were selected to show the greatest variation in contour of nostril, length of lip, and eversion of mucous membrane. I have done many more than here pictured and can say that no two babies look alike. How they will appear in adult life I do not know. It is for this reason that I am so specific in offering these suggestions only as a theory.

and he then had control not only of the lip, but of the right and left muscle groups of expression.

The Histology of the Lip.—The arguments of the muscle theory are most alluring and are so direct that I have been led to wonder why it was possible to have approached this repair by so many and various plans. I think the

FIG. 14.—I have had only one median cleft. It is a perfect example of lateral approximation because the cleft is at the top of the curve.

explanation lies in the study of the histology of this muscle. This reveals a most complicated picture of muscle bundles varying in size and distribution, connective tissue, glands and fat. Certain bundles appear to interdigitate,

FIG. 15.—Only one cleft lip bilateral has appeared during these studies of the muscle-theory. But it seems to work out on the plans described in the paper.

Nature's plan to permit of some special action of the lip other than sphincteric action.

CONCLUSION

Whatever plan is adopted, some kind of lip can always be made. The main point is whether the procedure results in the replacement of tissues in a way normal to the individual baby. There are three procedures in the litera-

ture that nearly meet the muscle theory: The Mirault method in which the undercutting of the ala most nearly resembles the incision for the exposure of the upper margin of the muscle; the Rose operation which symmetrically prepares for lateral union but I believe sacrifices tissue unnecessarily; and

FIG. 16.—The principle applied as a secondary repair.

the use of the Thompson calipres which, by the exact measurement of the normal and defective sides, offers the greatest chance of all the recent methods of exposing the muscle ends.

In conclusion I wish to again emphasize that the above is a theory and I do not believe that anyone with an established and satisfactory method should

FIG. 17.—This man of thirty years seems to answer the question raised in the paper. Is there muscle in the prolabium? Two mounds of muscle appear on either side with a thin skin and mucous membrane curtain between. When the muscle—perfectly possible at this late date—was brought together underneath, function of the lip, and coördination of the expression group was obtained.

change his technic. The battery may be used to check the lip and determine the value of the steps used. What I see in the theory is that it establishes a definite principle of function and thus institutes a change from indirect to direct surgical methods.

IMPORTANT FACTORS IN THE TREATMENT OF CLEFT LIP AND CLEFT PALATE

By Harold S. Vaughan, M.D.
of New York, N. Y.

In the treatment of complete congenital clefts of the lip, alveolar border and palate, the operation for repair should be performed as soon after birth as the baby's physical condition will permit. It has been shown that young infants stand operative procedures well and are not as subject to shock as when older. However, the first consideration should be to place the baby under the care of a pediatrician who directs its feeding. It is ready for operation after the birth weight has been regained and a steady gain is shown.

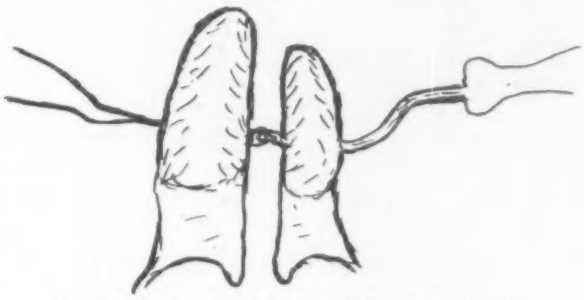

Fig. 1.—Pilot silk drawn through with open-eyed needle.

The chief advantage of early operation is that the bones are softer and more pliable before the third or fourth month. The displaced portions of the maxilla can then be more readily moulded into place and the alveolar cleft reduced or completely approximated.

Fig. 1a.—Silver wire being drawn through maxillæ.

Many surgeons fail to consider the necessary fundamental factors in the correction of these cases but close the lip defect without due regard for the support and cosmetic effect obtained by the correct relation of the alveolar border.

No matter how skilfully a lip is repaired over a wide alveolar cleft, deformity will result because of lack of support for the ala of the nose and adjacent portion of the lip. It is important to first restore the anatomical relations of the various parts. Closing the alveolar cleft serves to relieve tension on the stretched and flattened nasal ala, straightens up the distorted columella, which is usually inclined to the sound side. It also helps to form

a support and relieve the disagreeable depression of the upper portion of the lip. This principle is followed by Brophy, Thompson, Moorhead, Lyons and many others, in this special field, though the methods vary somewhat.

FIG. 2.—Silver wire approximating anterior portion of maxillæ.

The Brophy operation of forcible approximation of the two halves of the maxilla by means of silver wires twisted down on lead plates, set on the external aspect of the maxillary alveolars, is a severe procedure which offers greater risk of damaging the developing tooth follicles, and necessitates postponement of the lip operation to a later date.

By approximating the alveolar border the lip operation can be completed at once. If performed while the bones are still soft and pliable, the alveolar borders can be brought together by digital pressure and held by a through and through suture of silkworm gut in cases where slight separation exists, but if the separation is wide, silver wire of 18 or 20 gauge should be used. The wire is passed through the maxillæ in the molar region high enough to avoid the tooth follicles.

Technic.—By digital pressure and manipulation the alveolar borders of the cleft are nearly approximated. The cheek is raised, a heavy full curved needle, writer pattern, threaded with stout silk, is entered high up in the sulcus between the cheek and maxilla to avoid the tooth follicles, and passed through into the cleft; the silk loop is picked up with a curved hook and the needle withdrawn. Another needle of the same type with an open eye is passed unthreaded through the opposite maxilla, the point emerging in the cleft opposite the loop of silk, the loop is then slipped into the eye of the needle and drawn through. (Fig. 1 and 1a.) As the needle is withdrawn, the sharply bent end of a length of 18 gauge silver wire threaded on the loop end, and drawn through it, is then brought around across the cleft and twisted firmly against the maxilla as high up as possible in the alveolar-

FIG. 3.—Before operation.

labial fold on the opposite side. (Fig. 2.) The muscular action of a repaired lip will, in many cases, produce alveolar approximation but a flattened nasal ala and a depressed upper portion of the lip accompanies the failure to secure early anatomical relations.

The alveolar borders being approximated, the next step is repair of the lip. There are four important aims to accomplish.

1. To restore the flattened alæ of the nose to the contour and relation of the opposite side.

2. Construct a floor for the nostril and prevent the depression of the upper portion of the lip.

3. To obtain a continuous vermilion border and prevent the unsightly notch along the margin.

4. To evert the lip and give it natural prominence instead of the inward contraction or inversion.

The most important step in accomplishing the restoration of the ala of the nose is the complete undermining and separation of the ala and columella from their attachments to the maxilla. The mesial side of the cleft is pared close to the columella. In paring the distal side as much tissue as possible should be left to form a floor for nostril, prevent falling in that often results when line of union comes along alar side of nostril.

FIG. 4.—After restoration of lip and nasal ala.

With the lip well dissected from the maxilla and when suturing the internal surface, the first one or two sutures of fine silkworm gut should include a considerable area of the muscle on each side drawing it well together so as to carry the lip forward and produce greater thickness of the upper portion.

Many different incisions have been advised in fashioning the flaps for lip repair, some of which are very complicated. The results are usually better with the simpler incisions. The Rose operation usually gives satisfactory results but where the outer border of the cleft is much thicker than the inner, the Mirault incisions produce a more uniform vermilion border.

The use of calipers is a great aid in mapping out the incisions. The writer

does not know the originator of this method but their use was suggested to him by Ladd of Boston.

OPERATION FOR BILATERAL CLEFT LIP AND CLEFT PALATE

The complete correction of the above deformity is a rather severe operation attended with considerable shock. The writer considers it too extensive to be completed in one stage; therefore, to safeguard the infant it should be divided into two.

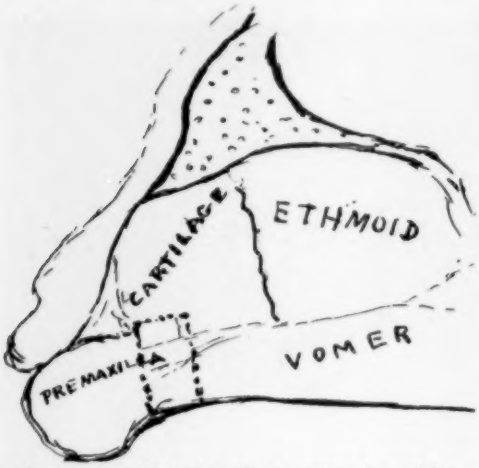

FIG. 5.—Quadrilateral section of septum for excision.

The first stage consists in the correction of the malposition of the premaxillary bone with its proper adjustment and fixation between the separated halves of the maxilla. In nearly all cases that come to the writer for palate operations, where the lip has been previously corrected, the premaxilla is found to be entirely detached and twisted out of shape with the incisor teeth directed posteriorly. This structure, when properly developed, performs the important function of holding the lip in normal position, and serves to prevent the distressing flatness so often seen in these unfortunates. The first steps are the same as in the operation for single cleft. The silver wire is passed through the maxillæ, an incision is then made along the lower border of the vomer. The mucoperiosteum and perichondrium is elevated. Then instead of removing a triangular section from the vomer as is usually suggested, a quadrilateral portion is excised, Fig. 5. The premaxilla is then carried posteriorly into its correct relation instead of being tilted backward, as happens when the triangular section is removed. In this way, the normal axial relations of the teeth are maintained. (Fig. 6.) The borders of the premaxilla and alveolar borders of the maxilla are freshened. One end of the silver wire is then carried through the soft tissues on the anterior aspect of the premaxilla. The alveolar borders of the premaxilla and maxillæ are freshened, the two ends of the wire are twisted compressing the two sides of the maxillæ so the premaxilla

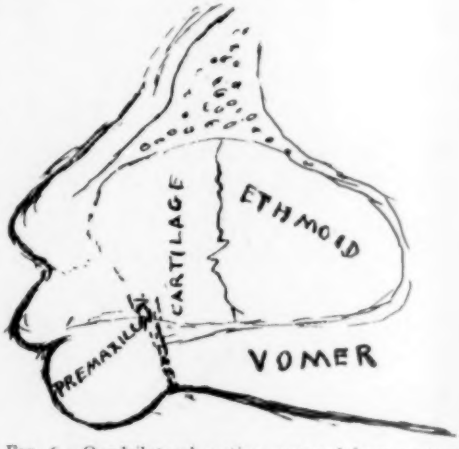

FIG. 6.—Quadrilateral section removed from septum and premaxilla in normal position.

is firmly wedged and held into its correct position. Silkworm sutures may also be used to approximate the mucous membrane. At this time the redundant flaps of mucous membrane turned down from the vomer can usually be sutured to the palate borders of the cleft as suggested by Pichler. This helps to close the anterior portion of the cleft (Fig. 7) leaving a better condition for the later plastic closure of the palate.

FIG. 7.—Premaxilla held in position and flaps from sides of septum sutured to palate.

The next step consists in the repair of one side of the lip. The vermilion border is excised from one side of the prolabium around to just beyond the median line. The facial attachment of the nasal ala is undermined, care being taken to allow tissue for a nasal floor. The lip is transfixed with a pointed scalpel near the junction of the skin and vermilion border at a distance to correspond to length of the prolabium. The incision extends upward and inward, forming a flap to be adjusted to the end of the prolabium as shown. (Figs. 8 and 9.) The first suture is of silkworm adjusting the nasal ala and corresponding lip tissue to the side of the prolabium, the other apposition sutures are of horsehair. It is desirable to place a tension suture to hold the nasal ala in position. This is done by passing a suture through to the ala and on through the columella. Very thin silver buttons are

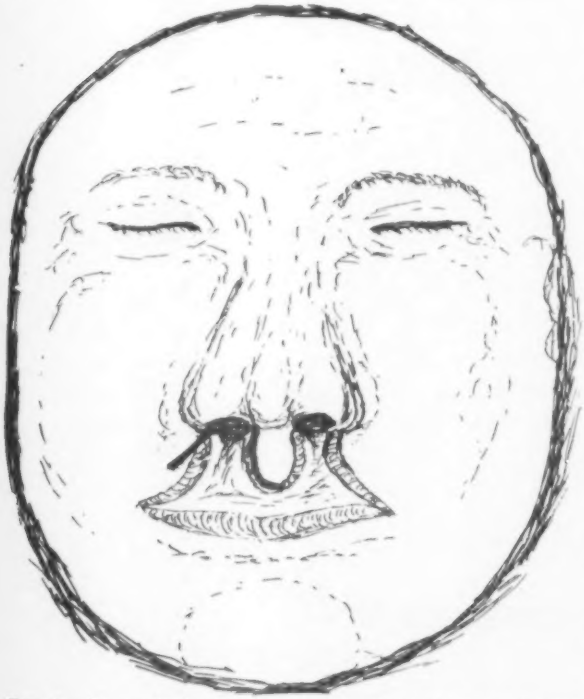

FIG. 8.—Removal of vermilion border and incision in external border of cleft.

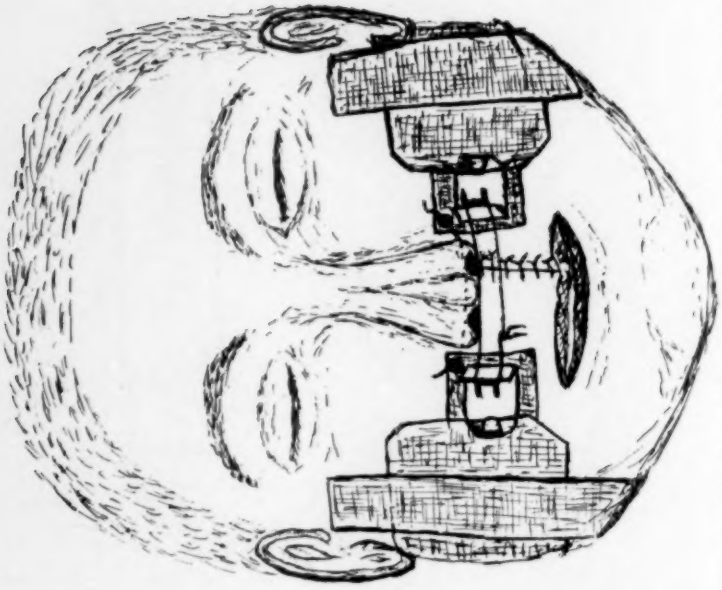

FIG. 10.—Adhesive strips with metal attachments for relief on tension.

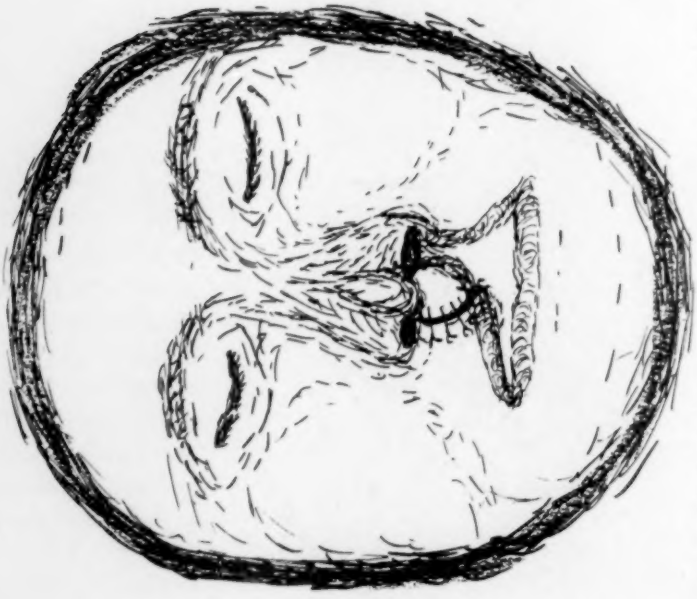

FIG. 9.—Suture line after adjustment of one side of bilateral cleft lip.

threaded over the silkworm, one in the opposite nostril the other external to the ala. They are held in position by perforated shot, compressed against the suture. It is advisable to also apply adhesive strips on each side. These are attached to metal clips so they can be tied together to the correct tension to relieve the suture line. (Fig. 10.) The opposite side can be operated any time after three or four weeks, depending upon the condition of the baby. The same general procedure is followed as for repair of a unilateral cleft lip. (Figs. 11, 12 and 13.)

FIG. 11.—Bilateral cleft lip before operation.

TIME TO OPERATE FOR CLEFT PALATE

As previously stated, the time to operate for cleft lip and especially when associated with a cleft through the alveolar border hard and soft palate, is as soon after birth as the infant's physical condition will permit, as shown by a proper adjustment of the feeding problem and consequent steady gain in weight.

FIG. 12.—Bilateral cleft lip after unilateral repair.

The operation for adjustment of the bony structures of the palate is, therefore, closely linked up with and a part of the cleft lip operation. The operation for the plastic closure of the hard and soft palate is a distinct procedure and governed by entirely different considerations. The early surgeons, especially before the days of general anæsthesia, waited until after puberty or early adult life before attempting to correct a congenital palate defect. Some surgeons, at present prefer to operate between the fifth and tenth year, though the majority of experienced operators in this field, correct this deformity between eighteen months and two years of age, or slightly later.

In favor of operating at this time is the fact that as the teeth erupt the alveolar process develops, the palate becomes more arched and gives more tissue to close the cleft. The palate tissues are more developed, thicker and less friable. The palate is closed before the child begins to talk and before the characteristic cleft palate speech is established.

Another very distinct advantage in favor of operation at this time is that the child obtains a more normal nose and nasopharynx, less congestion of the mucous membrane and is less liable to nasal infections.

FIG. 13.—Bilateral cleft lip. Complete repair.

CLEFT PALATE OPERATION

Favorable results in the repair of cleft palate depend upon a recognition by operator of several important factors:

1. Recognition and conservation of the blood supply in the preparation of flaps.

2. Lateral incisions only of such extent as to permit approximation without tension.

3. Supplementary support of the suture line by immobilization of the soft palate.

4. Support of the suture line in the hard palate and relief from tongue pressure when necessary.

The blood supply is derived chiefly from the two divisions of the posterior or descending palatine arteries from the internal maxillary, which emerge from the palatine foramina opposite the second molar in the adult or just internal to the maxillary tuberosity in the infant. The larger branch passes forward close to the alveolus to anastomose with the anterior palatine which is derived from the naso palatine and comes through from Scarpe's foramen behind the anterior teeth, thus furnishing the supply for the hard palate.

The blood supply of the soft palate is from the smaller branch of the descending palatine, from the ascending palatine, a branch of the facial, and ascending pharyngeal, which is given off from the external carotid.

The Von Langenbach operation, with modifications, gives the best results.

After the soft tissues have been elevated from the palate by blunt dissection, beginning at the cleft and working out toward the alveolus, the two

sides will drop and tend to approximate in the median line. This will be further increased when the aponeurosis which attaches the soft palate to the posterior border of the palate bone has been cut, and may be quite sufficient for approximation when the cleft is narrow. But all wide clefts require lateral incisions to permit closure, if undue tension is to be avoided. The incision should always be made close to the teeth so as to traverse the palate external to the palatine arteries. It may also be necessary to extend this incision posteriorly around the tuberosity. Then with special elevators the flaps are worked towards the median line until they can be brought into contact. With due care the artery will stand considerable stretching. Complete support for the suture line of the soft palate may be obtained by the use of the Mackenty lead ribbon which is passed around the palate and tied together in the median line.

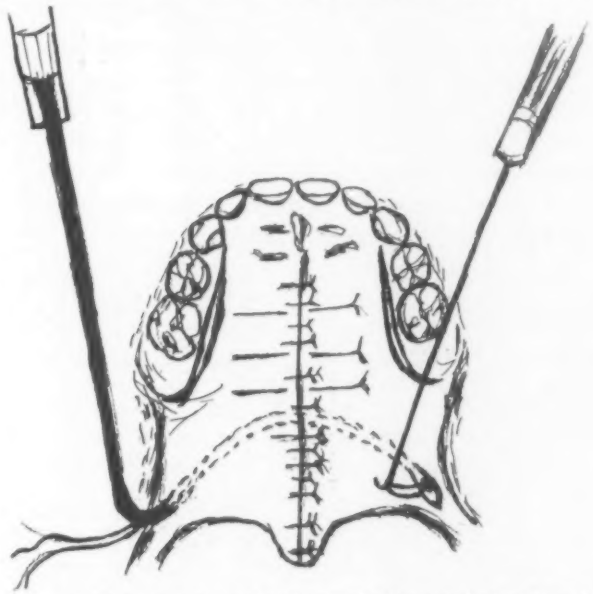

FIG. 14.—Pilot suture being passed around soft palate for insertion of flat silver wire sutures.

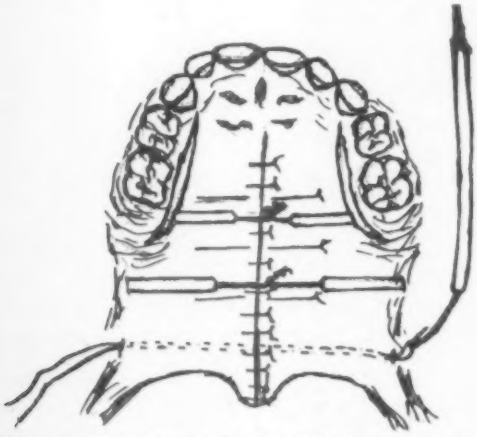

FIG. 15.—Flat silver suture about to be drawn through by pilot suture.

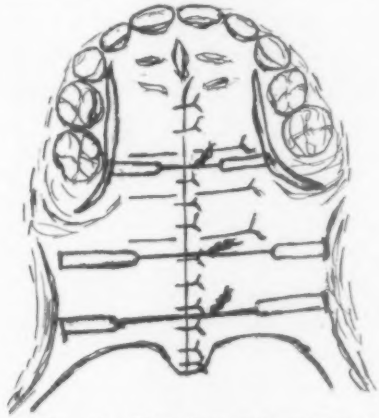

FIG. 16.—Flat silver wire sutures in position to relieve tension on suture line and for immobilization of soft palate.

The writer has recently adopted a method for immobilization of the soft palate by the use of flat silver wire sutures, which pass around the palate the same as the Mackenty ribbon. The ends of the wire are left round so they can be readily tightened by twisting. (Figs. 14, 15 and 16.)

Support of the suture line in the hard palate is advisable in the case of wide clefts that extend through the hard palate and especially where the highly arched vault of the palate has been greatly reduced. The space normally occupied by the tongue is thus encroached upon to a considerable extent. Therefore, after suturing there may be pressure by the tongue on the suture line. This pressure can be obviated by the use of the flattened silver wire tension sutures which are passed around the palate through the lateral incision. One or two may be needed. They are also useful to retain dressings along the suture line when necessary.

Iodoform gauze is usually packed in the lateral incision as it tends to hold the flaps over, and prevent infection.

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THE TREATMENT OF RODENT ULCERS BY RADIATION

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Radiation treatment of basal-cell epitheliomata is popular with dermatologists and radiologists because their common experience is to observe a rapid disappearance of most of these lesions under this form of treatment, with excellent cosmetic results. The method is further liked by both physician and patient because of absence of operative procedure and for its simplicity of application.

Those who oppose this form of treatment do so in the belief that the uncertainty of a permanent cure is very great, and that there is a large percentage of recurrence. This belief does not find support in the figures of careful observers. Hazen [1] recently reported a series of 244 basal-cell tumors treated by radiation, with 33 failures or recurrences from the first series of irradiation (about 14 per cent.); and 5 of these were cured by a second course. MacKee [2] followed 282 clinically cured patients for periods varying from six months to nine years, and found 36 relapses, 13 per cent. As a basis for comparison, Hazen [3] collected a series of surgical results from Johns Hopkins Hospital and found 86 per cent. of cures in unselected patients. The percentage of cures from the two methods would therefore seem equal, and both fairly satisfactory.

A second, and better founded cause for opposition to radiation treatment, is found in the occasional patient who has had an extensive or resistant lesion, which has been treated over a long period of time, with many applications of X-ray or radium, and who eventually comes to surgical treatment with such an extensive lesion, and with tissues so badly damaged by radiation, that he presents to the surgeon a well-nigh hopeless condition.

Such unfortunate results, and grounds for opposition to radiation, could be easily avoided if we would frankly recognize at the start the limitations of this method of treatment, and not attempt too much. If there is not an immediate response to one or two doses of radium, surgical excision should be resorted to. Rodent ulcers involving bone or cartilage are cured with the greatest difficulty, if at all, by radiation. And very large (roughly, 4 cm. in diameter, or over) or very old lesions are difficult to cure. It is our feeling that most lesions of these types should be seen in consultation by a surgeon experienced in cancer work, and treatment of them by radiation should be undertaken only if the surgeon considers they are for any reason unsuitable for operation.

The third objection to radiation is based on the occasional error in diagnosis which results in the treatment by radiation of a supposed basal-cell growth, which eventually proves to be squamous celled. Whether the treat-

ment of squamous-cell epithelium by radiation should be undertaken or not, we do not propose to discuss in this paper, but the fact is well recognized that this latter form of growth is very much more difficult to cure by X-rays and radium than the former. But we do not feel that such a mistaken diagnosis adds very much risk to the patient if the following rule is adopted. Whenever a lesion shows any increase in size after treatment, or whenever a lesion does not show very striking response to one or two doses of radiation, the patient should be referred at once for surgical removal and pathological examination of the specimen. If this rule is followed, the patient reaches the surgeon with the lesion still small, and with little radiation damage to the surrounding tissues, and the dangers of recurrence have probably been increased little, if any. We feel, also, that this rule is equally desirable for the occasionally encountered very resistant basal-cell tumors.

Our figures from the New York Skin and Cancer Hospital are given as a preliminary report only, owing to the recent organization of its present department of röntgenology. Only the radium treated patients are used in the following figures as our records of these patients are more complete.

Our records show that during the past twenty-two months we have carried through to completion the radium treatment of fifty patients with clinically diagnosed basal-cell epitheliomata. Among these there were five primary failures, or 10 per cent. One of these, which involved an extensive area of one cheek, we had from the start considered too large to be suitable for radiation; and although the lesion showed considerable improvement from two applications of radium, we persuaded the patient to consult one of our surgeons, feeling that surgery offered the better prospect of permanent cure.

The pathological report of two of the remaining four failures, surgically removed, was squamous-cell epithelioma. An interesting feature was that one of these patients gave a history of three years' duration of the lesion. Both these patients have been seen within a month, and are well, three months and ten months after excision.

The remaining two of the five failures were also referred to the surgical department and advised operation, but did not come into the hospital. If we assume that their lesions were basal-cell epitheliomata, we have in our series about four per cent. of these lesions found entirely resistent to the usual dosage of radium.

We have been able to follow twenty-nine of our clinically cured patients for periods varying from three to nineteen months after their last radium application, a general average of seven months. There have been three recurrences in this series, about ten per cent. One of these recurred seven months after her last application of radium. She received another treatment, and is well at present, seven months later. A second patient had a recurrence five months after treatment. She received another application of radium, but did not report in again, and we have been unsuccessful in our attempts to follow her up. The third patient had a recurrence in one of a number of lesions

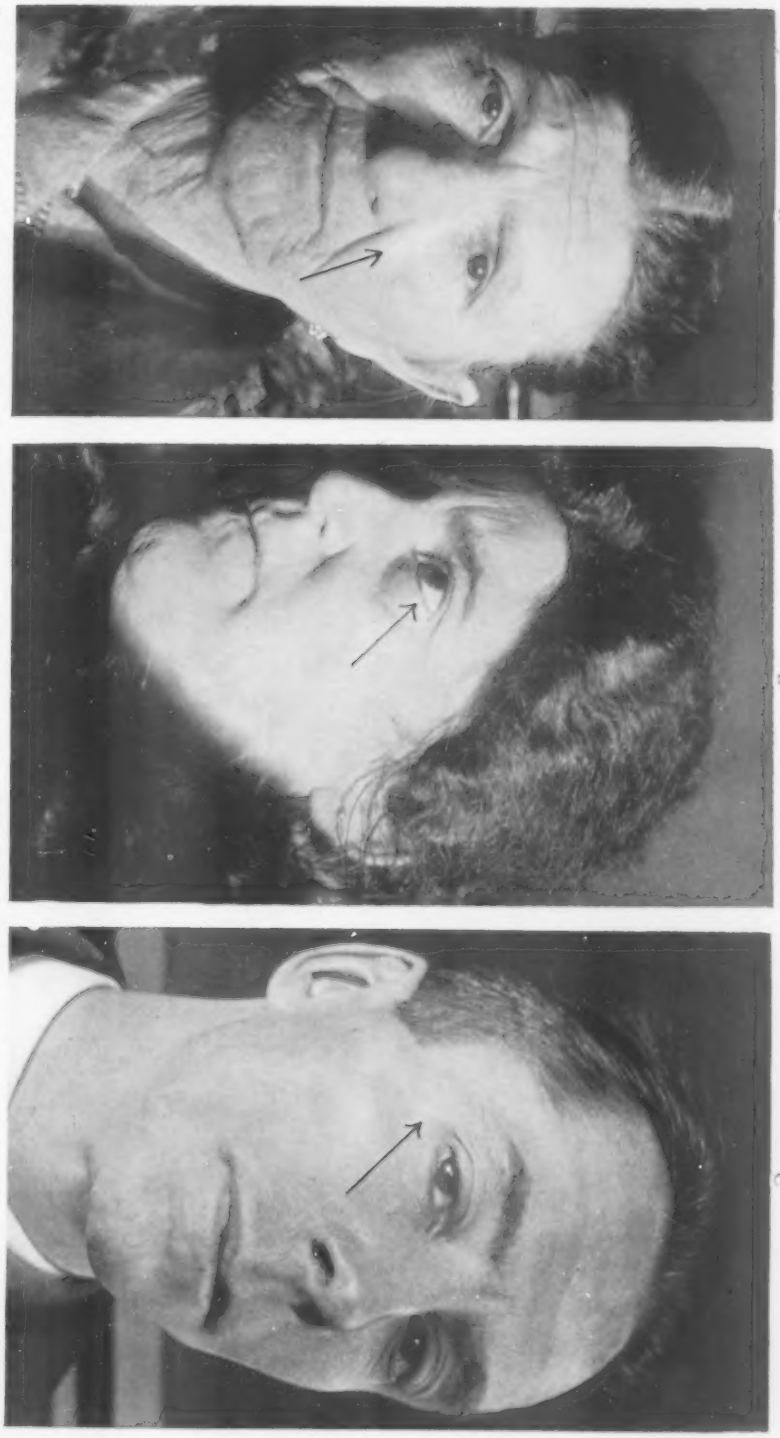

FIG. 1.—Results of radiation on rodent ulcers. A. Three applications, the last one twelve months prior to the photograph. B. Two applications, the last one seven months prior to the photograph; permanent epilation of a few lashes of the lower lid. C. Two applications, the last one six months before photograph.

we treated on his face, four months after completion of treatment. He has received another radium application on this lesion within the past few days.

SUMMARY

1. Radiation treatment of basal-cell epitheliomata is an excellent method because of its absence of operative procedure, its simplicity, excellent cosmetic results, and high percentage of permanent cures.

2. Statistically, there is little difference in the ultimate results between treatment by radium and that by surgical excision.

3. The treatment by radiation of those lesions where bone or cartilage is involved, or where the lesion is 4 cm. in diameter, or larger, is inadvisable. Treatment by radium should be undertaken in these conditions only when a surgeon, skilled in the treatment of cancer, finds the patient, for any reason, unsuitable for operation.

4. The patient's risk, in treating, through mistaken diagnosis, a squamous epithelioma, is probably little, if any, increased, if the rule be observed to refer promptly for surgical removal any lesion which increases in size after radiation, or any lesion which does not respond immediately and strikingly to one or two doses of radiation.

5. A preliminary report of basal-cell lesions treated by radium at the New York Skin and Cancer Hospital is given. The authors desire to express their thanks to Doctor Watters, of the Interne Staff of the New York Skin and Cancer Hospital, for the excellent photographs.

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FREE, FULL-THICKNESS SKIN GRAFTS*

By Clarence A. McWilliams, M.D.
of New York, N. Y.

Ollier-Thiersch skin grafts are very simple in the technic of making and most successful in their results. It is a procedure that most house surgeons carry out with great success. But Thiersch grafts have this disadvantage, they frequently ulcerate, and also contract, from the thinness of the epithelial covering, allowing shrinkage of the underlying connective tissue. Were the principles of the application of free, full-thickness grafts more generally understood, these grafts would replace Thiersch grafts in a large per cent. of instances, and the successes with them would be just as great as with Thiersch grafts. The histological basis of the nourishment of these full-thickness grafts has been put on a firm scientific basis by Staige Davis. He has experimentally proved that for 24 hours, nourishment is by inhibition of plasma from the host into the graft, followed, after 24 hours, by an actual anastomosis of like-sized capillaries between host and graft; and then takes place an upward growth of capillaries from host inside the old vessels of the graft. The circulation is finally completed, not before the eighth day, at the earliest, by the growth of arterioles into the graft, when the blood supply then becomes adequate to fully nourish the graft. He has also shown that by removing the fat from the graft by scissors, capillaries are pinched and become occluded, consequently, it is wiser to remove the fat by a sharp scalpel. Only by careful attention to minor details is one sure of success with full-thickness grafts. Ferris Smith has computed the previously unknown amount of pressure to be applied to these grafts, to insure success, by ascertaining, by experiments, that 30 mm. of pressure is just the proper degree. He has devised (Fig. 8) an inflatable, rubber balloon to be incorporated in the dressing over the graft. This is a great advance in technic and takes the procedure out of the realm of uncertainty, for with the ordinary varying amounts of pressure obtained by a sponge, bandaged over the grafts, one never knows just the degree of pressure that is obtained. Probably this changing and uncertain amount of pressure explains the non-success of this method of grafting in the hands of many surgeons, for just the right degree of pressure is essential. For pressure conditions the nourishment of the graft, too much pressure will close the capillaries, shutting off the blood supply, and too little will allow the floating off of the graft from its underlying raw base by the effused serum, each being fatal to the life of the graft; hence, the great advance Ferris Smith has made in ascertaining just the amount of pressure necessary to insure success, and also an accurate method of applying that degree of pressure best, by means of an inflatable, rubber balloon.

* Read before the American Surgical Association, May 24, 1926.

FIG. 1.—Upper chronic X-ray dermatitis (sweating) with dime-sized squamous cancer ulceration in one palm. Removal of entire palmer skin of both hands down to palmer fascia. Lower, full-thickness, free graft to left and pedicled abdominal flap to right. Notice (right) redundancy of pedicled abdominal flap, due to fat; a disadvantage, requiring secondary removal of fat to make good cosmetic result.

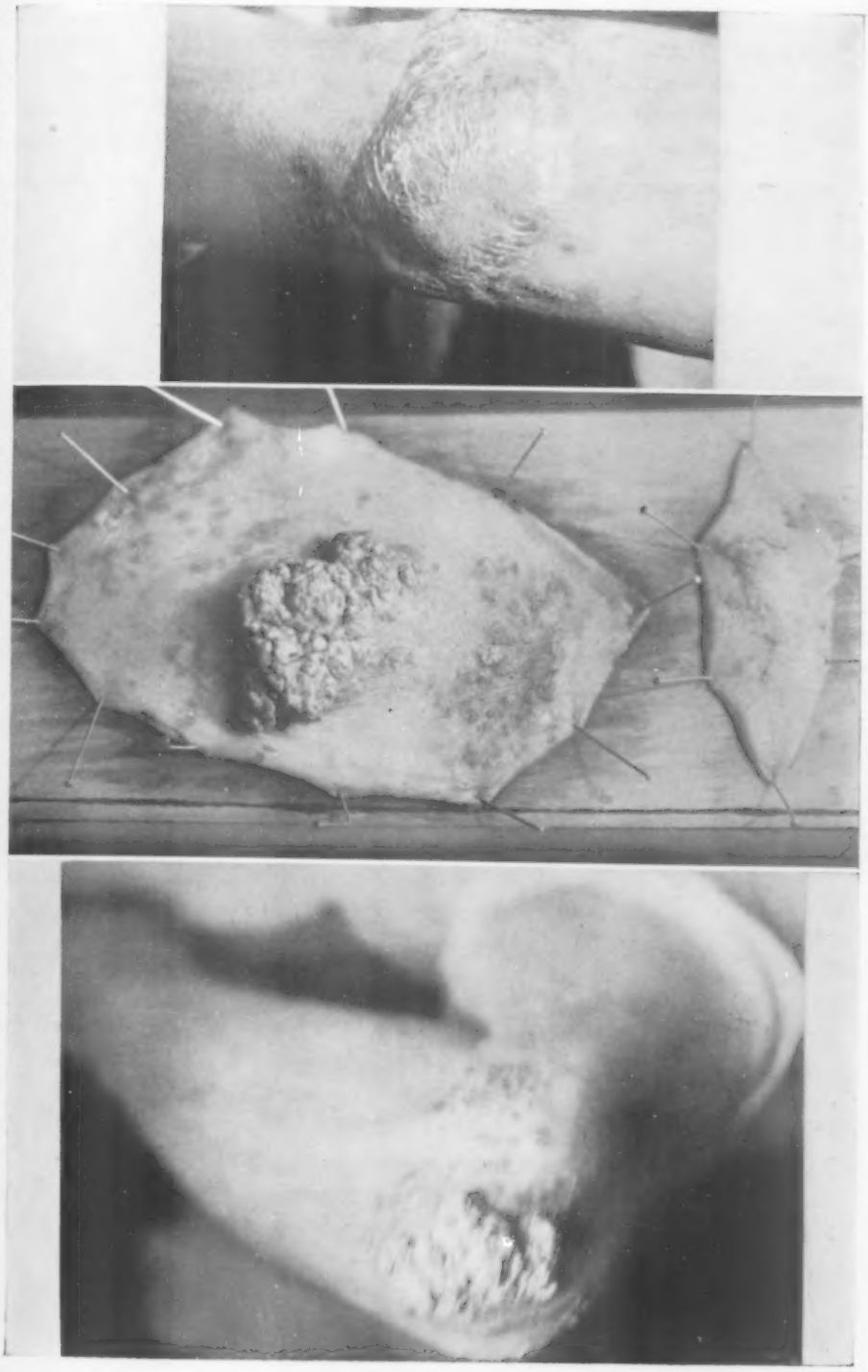

FIG. 2.—Left tuberculosis verrucosa cutis of elbow. Middle upper area excised, including tumor and affected skin. Result from full-thickness graft, with perfect flexion and extension of forearm. Severe test of full-thickness graft.

The technic of making full-thickness grafts is more exacting than is the making of Thiersch grafts, but is soon mastered, and my house surgeons are now just as expert in fashioning them as Thiersch grafts. The method of technic is as follows:

1. Autographs are always to be chosen since isographs are very uncertain.

FIG. 3.—Squamous-celled ulceration back of hand, duration five months, size of dollar. Excision, exposing tendon sheaths. Severe test of full-thickness graft, owing to poor circulation in base. Excellent result without any stiffness of fingers. Axillary nodes dissected and found uninvolved. Well one year after operation.

2. Fresh, sterile operating wounds, and fine, granulating (sterile) areas are equally successful.

3. Fresh fat and bone, bare of periosteum, are not usually successful areas to be grafted upon with free, full-thickness grafts.

4. Where contractions should be avoided (as about eyes and joints), free, full-thickness grafts should always be used rather than Thiersch grafts.

5. Grafts must be free of fat, which should preferably be removed by knife rather than scissors, to avoid pinching the capillaries.

6. No pinching of grafts with forceps is allowable.

7. The grafts are to be cut of exactly the same size (no larger) than the raw area to be grafted so as to preserve the normal tension of the skin to keep the capillaries open.

8. Making perforations in the graft is not essential.

9. The grafts should be sewn in all about the edges accurately with close, interrupted stitches, so as to maintain the normal tension, thus keeping the capillaries open.

10. Even, firm pressure of 30 mm. should be applied upon the grafts by means of an inflatable, rubber balloon (Ferris Smith).

11. Absolute immobilization is essential for at least five days so as not to disturb the growing capillaries.

12. There is no limit to the size of the grafts which may be successfully transplanted.

Successful Situations for Full-thickness, Free Grafts.—1. When applied on fresh muscle and fascia, including pericranium and periosteum. 2. On bared sheaths of tendons, whether granulated or fresh (Fig. 3). 3. On palmer fascia of hand (Fig. 1). 4. On fine, clean, granulating areas generally, except the neck (see below).

Unsuccessful Situations.—1. On bone, bare of periosteum or pericranium. Bare skull bones are successfully grafted with Thiersch grafts. There are not sufficient capillaries on fresh, bare skull bones to nourish full-thickness grafts. 2. On fresh fat. This should be allowed to granulate first, if grafting with full-thickness grafts is contemplated. 3. The neck is not a successful position for full-thickness grafts because of the difficulty of complete immobilization. Around the larynx, movements are constant from coughing and swallowing, despite all plaster-of-Paris devices. Ferris Smith has suggested wiring the teeth together to prevent movement through the lower jaw. 4. The face is an admirable situation for full-thickness, free grafts. 5. Over joints Thiersch grafts should not be used because of their tendency to contract. Free, full-thickness grafts, or pedicled flaps, should be here employed.

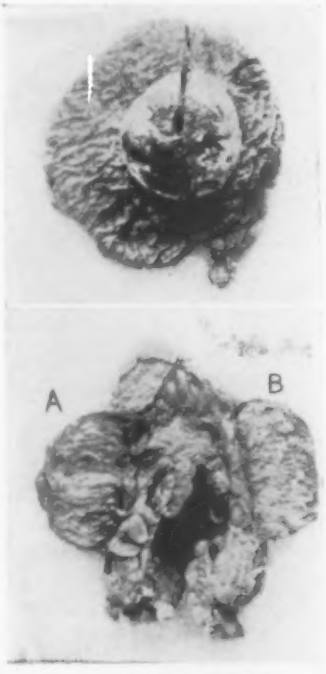

FIG. 4.—Squamous-cell epithelioma, removed from forearm with wide excision locally, and dissection of axilla (uninvolved). A, B, tumor cut open.

One of the great advantages of the full-thickness graft is its frequent mobility on the deeper parts (Fig. 2). This seems to be due to the fact that the fine connective-tissue layers underlying the normal skin are not entirely removed with the fat. These strands seem to proliferate, affording movement to the skin graft overlying them. It has been observed that there will result frequently several necrotic areas on the surface of the grafts, and the appearance is very discouraging for final success. But much to one's astonishment, these areas usually fill in with healthy skin without scar for-

mation, due to the fact that the *entire thickness* of the graft has not necrosed away, and there is epithelial regeneration completely from the depths as well as from the sides, just as happens when the outer surface only of the skin is excoriated away. This heals usually without a scar. When a wound goes through the entire thickness of the skin, a scar will usually result because of the separation of the edges and the filling up of the cavity by connective tissue from that lining the bottom.

FIG. 4a.—Result of grafting free, full-thickness skin graft into defect. Well three years later.

An ideal application of free, full-thickness grafts is in the treatment of the defects resulting from the surgical removal of rodent ulcers (Fig. 5), provided that the whole thickness of the cheek, opening into the mouth, has not been excised, in which case pedicled grafts will be required. Whether radium should first be tried in the treatment of rodent ulcers, rather than surgical excision, the author, as the result of experience, has for his own guidance formulated the following rules: If the ulcer be not large (*i.e.*, over 4 cm. in diameter) or of not too long duration (over one year), and if it does not involve bone or cartilage, then the results are equally as good with radium as with surgical excision, and the choice as to the variety of treatment may safely be left to the patient. When the above conditions are not present, however, surgery had best be used in the beginning. The technic of a full-thickness graft is a much simpler method than a pedicled graft, a method which has been so ably presented before this Association by Doctor Horsley. There is only one operative procedure necessary in making full-thickness grafts, and there is no additional scarring. It can be frequently done under local anæsthesia in one's office. It would seem to the author that a free, full-thickness graft should first be tried after excising the ulcer, and, if it be not successful, one always has then, as a last resort, the successful pedicled graft. If the technic of making full-thickness grafts is carefully carried out as to details, and is not modified, the success thereby obtained will be just as frequent as with Thiersch grafts. My own personal experience with full-thickness grafts applied to granulating areas has been small, but, regarding this, Staige Davis, in a personal communi-

FIG. 5.—Examples of rodent ulcers of face treated by excision and free full-thickness skin grafts, a very favorable location for these grafts because of the rich blood supply.

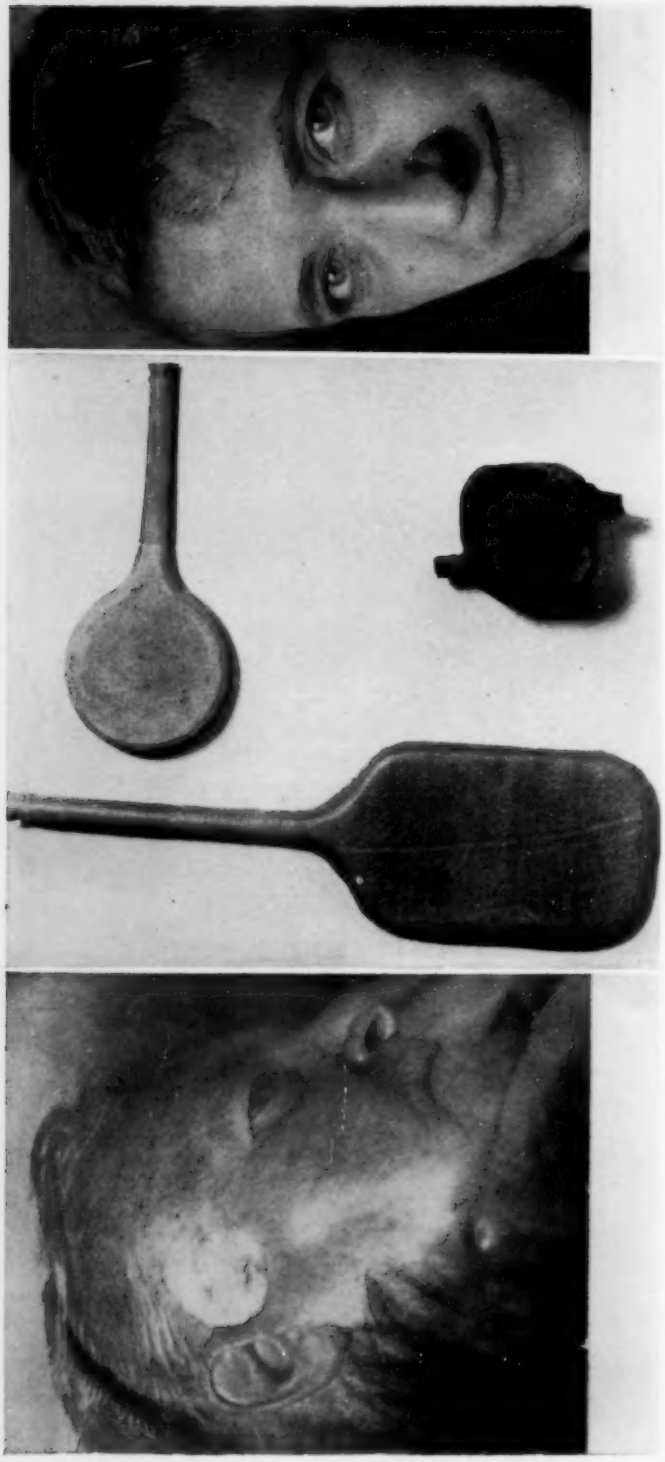

FIG. 6.—Various forms of Ferris Smith's inflatable rubber balloons. To be incorporated over full-thickness grafts in the dressing, and inflated to 30 mm., exercising just the proper degree of pressure (important point in technic). Lower right, two-way inflatable, rubber balloon over nose so that it can also be used with continuous flow of cold water for inflammations.

cation, says: "My first use of the whole thickness graft was on granulating surfaces, and I find that, if the granulations are flat and clean, that whole-thickness grafts take just as well, if not better, on granulating surfaces than on fresh ones. I account for this by the fact that the granulating buds have already started and penetrate the grafts rapidly."

With the additional pressure balloons of Smith (Fig. 6), we have a procedure in full-thickness grafting which is precisely scientific and exact in all its details, accurately worked out, and should give surgeons 95 per cent. of favorable results, with as great a frequency of successes as after using Thiersch graftings. In my own practice full-thickness grafts are now employed twice as frequently as Thiersch grafts.

A PLASTIC OPERATION ON THE CHEST*

By Arthur M. Shipley, M.D.
of Baltimore, Md.

I am reporting this case to call attention again to the use of wire and buttons in plastic surgery and because it is further evidence that the clean

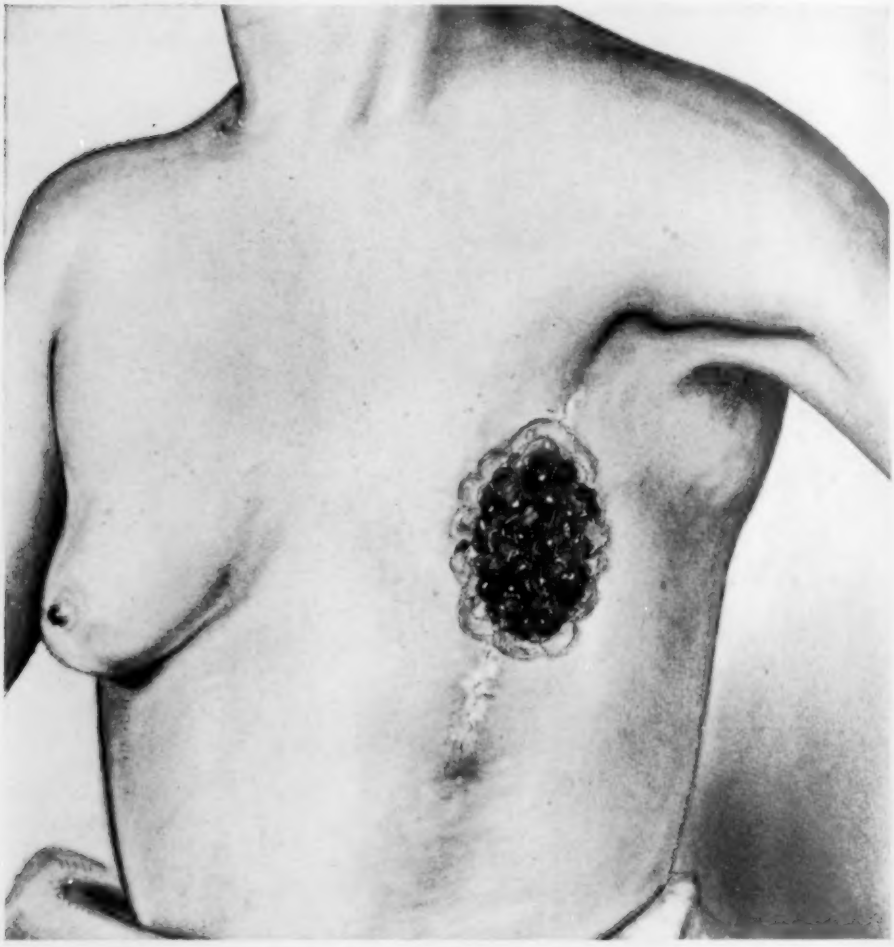

Fig. 1.—Recurrent carcinoma of breast.

chest can ordinarily be opened and closed without especial anxiety and without elaborate preparation as to the anæsthetic.

I saw this woman for the first time in April, 1919. She had a lump in the left breast which had been present for three and a half years. She had been under treatment at irregular intervals by her physician, who had given her potassium iodide.

* Read before the American Surgical Association, May 24, 1926.

The mass was not large and occupied the central portion of the breast. There was considerable retraction of the nipple, but there had been no ulceration of the skin about the nipple previous to the appearance of the lump. The patient was very thin, but this was not a recent development as she had always been thin and frail in physique. The breasts were both small, with very little muscle between the breast and ribs. The mass in the left breast was adherent to the chest wall and to the skin and there were a number of hard, small shot-like masses in the left axilla. The patient's general health was not impaired.

FIG. 2.—Excision of a portion of the chest wall.

A radical breast amputation was done and great care was taken to do a complete axillary dissection. The pathologist's report showed a scirrhous carcinoma of the breast with metastasis to the axillary lymph-nodes. The patient made an uneventful recovery and the skin united everywhere.

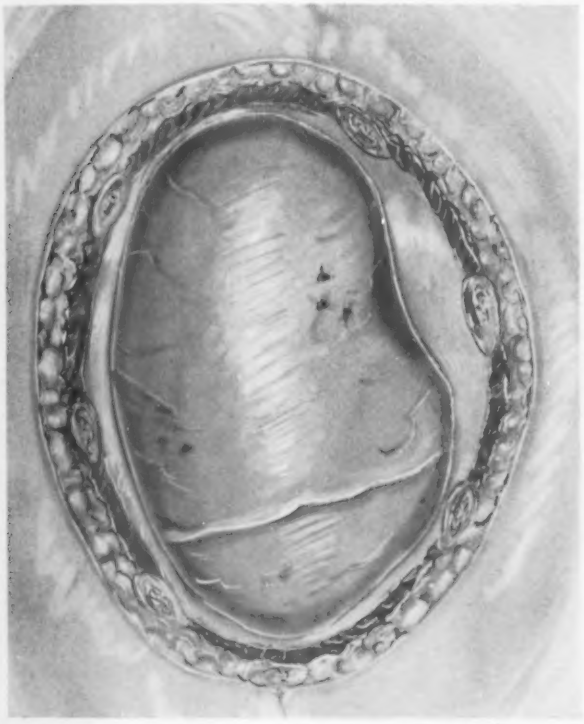

FIG. 3.—Defect in the chest wall showing different structures.

In March, 1923, four years later, she came to see me again, and at this time there was a small ulcer in the scar. It had been there for six weeks. This ulcer was small and no other evidence of recurrence could be made out, either in the skin of the chest wall, in the axilla or in the neck. This small ulcer was excised under local anæsthesia and it was reported scirrhous carcinoma.

In April, 1925, I saw this woman again. It was now six years since the first operation and two years since the small ulcer was removed. At this time there was extensive recurrence of the skin and chest wall over the site of the amputated breast. There was no evidence of recurrence in the axilla or metastasis in the neck and the X-ray examination of the chest was negative. The patient's general health was good, although she was still very thin. Because of the extreme thinness of the chest wall and the extent of the malignancy, it was believed that it might be impossible to get away

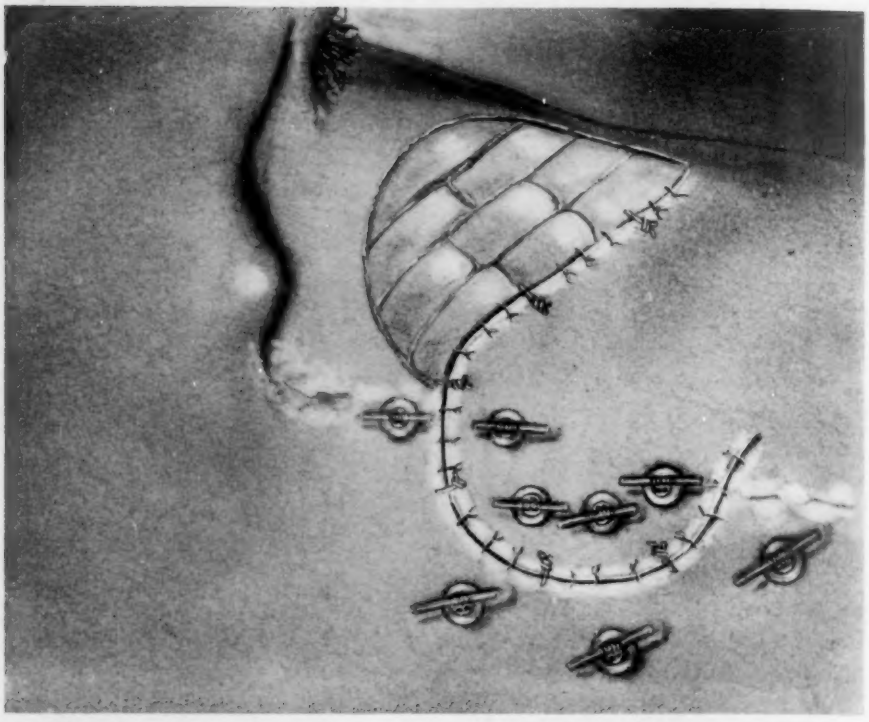

FIG. 5.—Completed operation. Thiersch grafts used to cover denuded area.

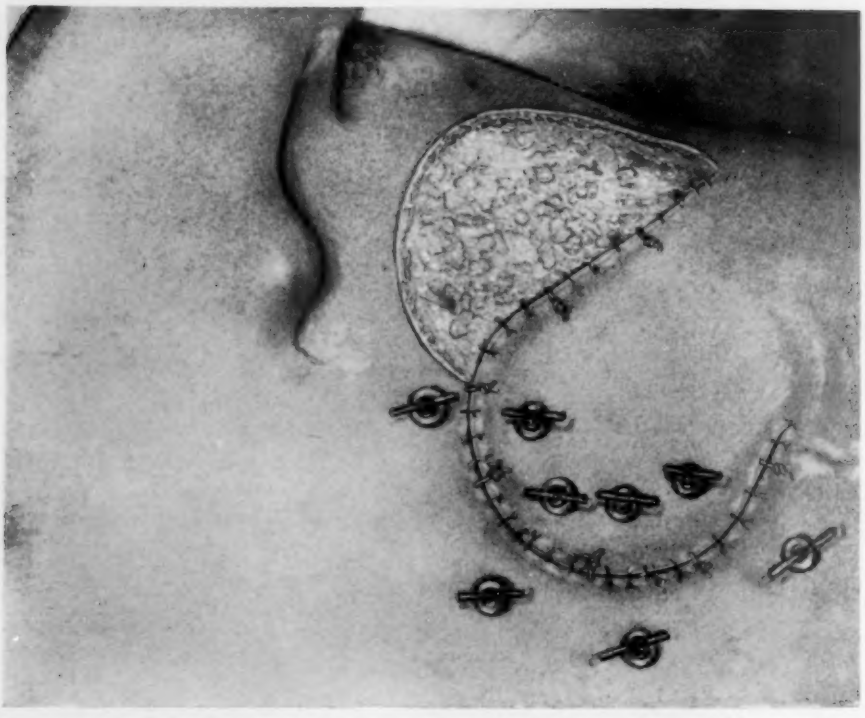

FIG. 4.—Flap of skin, fascia and muscle used to cover defect.

the carcinomatous mass without opening the pleural cavity, so that preparation was made for differential pressure anæsthesia. There was no effusion in the pleural cavity. The cancer had infiltrated the entire thickness of the chest wall, however, and as this was the second local recurrence without general metastasis, it seemed useless to do anything less than a radical excision of the mass. This would be difficult because the previous operation had removed all muscle and fascia from the ribs. The skin was firmly adherent to the ribs and there was considerable involvement of the bone and periosteum.

FIG. 6.—Photograph of patient one year after operation.

An attempt was made to separate the mass from the underlying pleura, but without success, so that in getting away the carcinomatous area a large defect was made in the chest wall including the pleura. The lung collapsed on this side, to a moderate degree. The breathing of the patient was not disturbed to any considerable extent and the heart action continued about as it was before the chest was opened. There was no mediastinal flutter. The opening in the chest wall, however, was kept closed with gauze, as much as possible, during the entire time that the thorax was open.

Closure of the defect presented a difficult problem, because of the extensive previous operation which had removed all muscle and fascia in the immediate neighborhood and because of the patient's extreme thinness. Sliding the opposite breast across the chest on the defect was considered, but this was not possible as the opposite breast was very

small, there was no subcutaneous fat and very little muscle and the skin everywhere was quite taut.

A pedicle flap was fashioned, therefore, from the axilla on that side with the base down. This flap was taken from over the serratus magnus muscle and lateral to the original field of operation. It was still a very thin flap and considerable doubt was felt as to whether it would live. A broad base was left, however, and it was turned into the defect with very little tension. The edges of the original wound had been undermined about an inch and tension was removed from the suture line by the use of silver wire, buttons and pieces of matchstick. The wire was carried through the skin on a heavy needle and brought out on the skin about an inch away from the wound edges. The buttons were threaded down on the end of the wire and the wire tightened by wrapping it around pieces of matchstick. This is a very simple manœuvre and the sutures can be tightened or loosened at will, by twisting or untwisting the matchstick. The edges of the skin were then approximated by interrupted sutures of fine silk. These were interspersed at intervals with interrupted sutures of wire. Care was taken to make the suture line air-tight.

The defect in the lateral chest wall was covered by Thiersch grafts taken from the thigh. During this time the breathing remained quiet, heart action regular and the color of the patient good. The lung continued in a moderately collapsed condition, but there was very little movement in the lung on that side during respiration and no gross interchange of air through the wound during respiration. No attempt was made to expand this lung before putting in the last suture. An ordinary dry dressing was applied and the chest wall strapped moderately snug.

This patient made an uneventful recovery, the pneumothorax rapidly disappeared, no effusion occurred in the chest and the wound healed promptly throughout its extent, and when last seen one year later, was in good condition, without any sign of recurrence.

THE ADVANTAGES OF THE PRIMARY SUPERIOR POLAR ATTACK IN THE REMOVAL OF SUBSTERNAL THYROIDS*

By Donald Guthrie, M.D.
of Sayre, Pa.

The anatomical relations and the mechanical factors which are responsible for the production and development of substernal or intrathoracic goitre have been beautifully explained by Pemberton and Lahey.

It is in the removal of these substernal masses, often of great size, in a

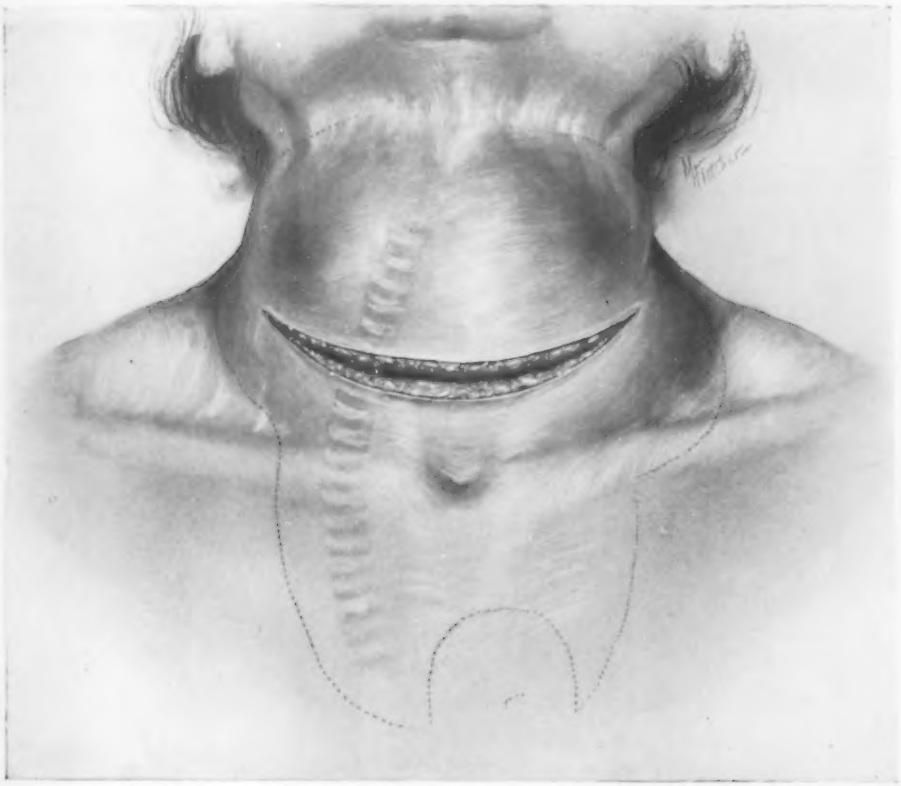

Fig. 1.—Collar incision. Drawing showing substernal enlargement with deformity of trachea.

patient who has severe mechanical difficulty with respiration that the surgeon gets his worst thrills, for tense situations are frequently wont to arise.

Pemberton, in 1920, suggested that the operation begin by a mobilization of the upper superior pole on the side which contains the substernal growth in contra-distinction to the accepted and generally employed method of primary elevation of the substernal mass and stated that this primary mobi-

* Read before The American Surgical Association, May 24, 1926.

lization and elevation of the superior pole, isthmus and visible part of the thyroid would usually cause the hidden mass to roll out of the mediastinum without undue traction or vain efforts to dislodge it. The likelihood of injury to the trachea, the recurrent laryngeal nerve, the need for immediate tracheotomy and the dangers of deep and concealed hemorrhage all being reduced to a minimum.

It is most important to obtain the best exposure of the thyroid bed at the beginning of the operation. The low collar incision should be long and the

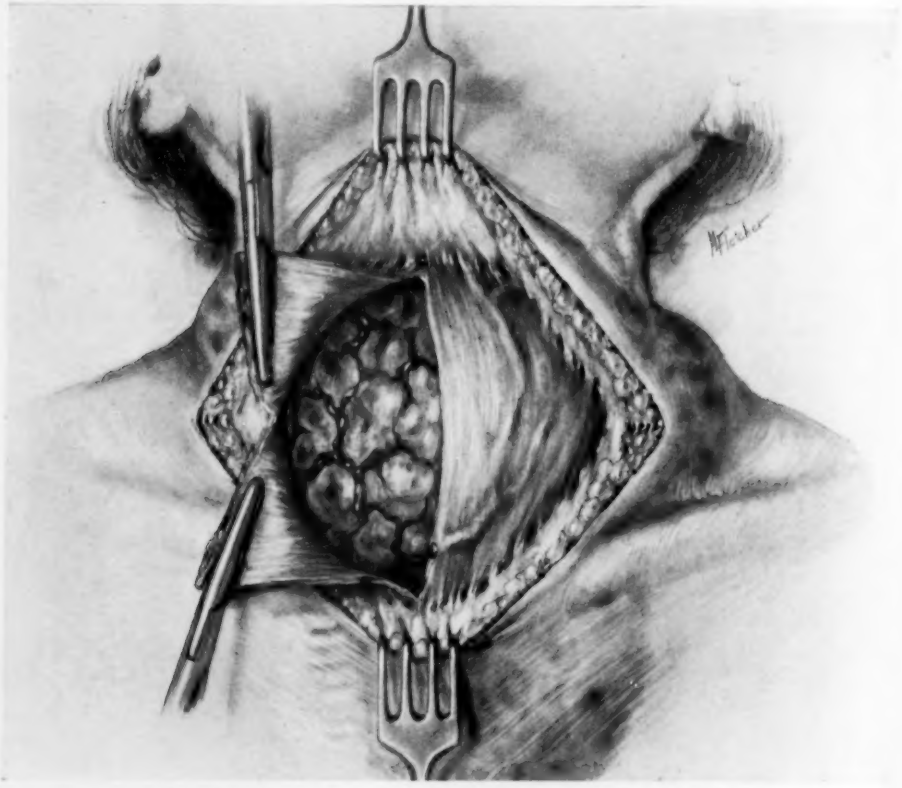

FIG. 2.—Unilateral section of muscles. Muscles are to be sectioned on opposite side.

skin and platysma muscle reflected well back on both sides. (Fig. 1.) All bleeding should be controlled at this step, as it is important to get rid of all clamps. The sternohyoid muscles on both sides are best clamped and divided and part of the sternomastoid may be cut if the exposure is not adequate. Free separation of the thyrohyoid muscle from the gland is important also. (Fig. 2.)

If cervical lobes are very large it may be best to resect the lobe on the opposite side to the substernal mass first, in order to secure additional space before the elevation of the offending lobe. This, however, is rarely necessary. The trachea should be located at once and a method for its rapid exposure planned should the respiratory difficulty become embarrassed enough during

this early attack upon the thyroid to warrant a tracheotomy. The upper pole is sought, severed between clamps and ligated at once. The attack then extends to the lateral thyroid veins, which are clamped and ligated, for it is unwise to allow many clamps to collect in the wound as their weight may increase respiratory difficulty to a dangerous form. With this amount of mobilization the upper pole is elevated and drawn gently downward from without inward or in a reverse manner, the manipulations of the surgeon being guided by the respiration of the patient and the helpful coöperation of an experienced anæsthetist. In the dissection at this stage it is well to leave small amounts of thyroid tissue on top of the trachea and at the side for protection of the trachea itself and the recurrent laryngeal nerve and the parathyroids. A clean fascial dissection in this area is fraught with grave dangers. (Figs. 3 and 4.)

FIG. 3.—Relation of recurrent laryngeal nerve to trachea and œsophagus. Anatomical dissection.

The ascending branches of the inferior thyroid artery are next encountered and after these are severed a wide degree of mobility of the gland will be found possible. In fact, very often, a large substernal mass may be elevated into the wound by the most gentle traction, occupying now the space above made vacant by the mobilized and elevated thyroid. All that is necessary is to ligate the inferior thyroid pole and remove the gland. (Fig. 5.)

It is not possible to employ the method herein described in the removal of all substernal thyroids. Many will have to be pried out of their beds hurriedly, others removed by morcellation, cysts will have to be ruptured to permit rapid removal, but many of these substernal masses can be easily removed in this way. When one compares this technic with the one of rapid elevation, attended so often by an increase in respiratory difficulties instead of respiratory improvement, the rapid and vain search for a hidden and deformed trachea in a neck already jammed with thyroid before the elevation

of more thyroid, the danger of further stretching an already overstretched recurrent laryngeal nerve, the danger of deep and alarming hemorrhage due to pulling off the inferior thyroid vein or artery, or both, and the liability of injury to the recurrent laryngeal nerve, the internal jugular vein or the parathyroids, as a result of the hectic efforts of the surgeon to control this severe and alarming hemorrhage, the advantages of the method are obvious.

Since employing this operation, we have not had the need for tracheotomy and we have been impressed by the lessened post-operative respiratory and voice difficulties in our work.

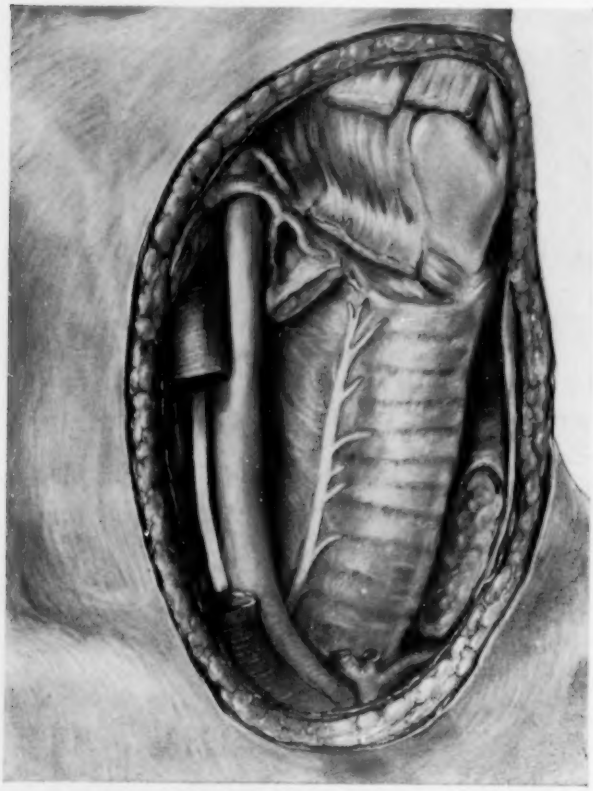

FIG. 4.—Relation of recurrent laryngeal nerve to trachea and œsophagus. Anatomical dissection.

In a paper in 1918, on the Temporary Loss of Voice following Thyroidectomy, the writer urged that the trachea and larynx be protected in all manipulations which would cause any change in the respirations of the patient during the operation for the removal of goitre. An ever-changing attack was suggested, which, with the coöperation of the anæsthetist was planned to proceed in any direction which was compatible with quiet respiration on the part of the patient and the direction of the attack be changed at once with the development of the slightest change in the patients respirations.

A clean dissection of the trachea was strongly advised against because of the dangers of post-operative voice difficulties due to tracheitis which follow irritations from such dissections and it was urged that small amounts of thyroid tissue be left on top of the trachea and along its sides as a protection to the trachea itself and recurrent laryngeal nerve.

Pemberton contends that local anæsthesia is safer than general anæsthesia in this type of work, because so many of these patients learn to employ the accessory respiratory muscles as respiratory difficulties increase and that a general anæsthetic destroys the coöperative action of these accessory muscles. We cannot quite agree with Pemberton on this point, because we have always

employed general anæsthesia in our work, and we have noticed no additional respiratory difficulties upon anæsthetizing these patients, or at the beginning of these operations.

The use of ethylene and oxygen anæsthesia is especially recommended in thyroid surgery. The absence of mucus and the quiet respiration make it

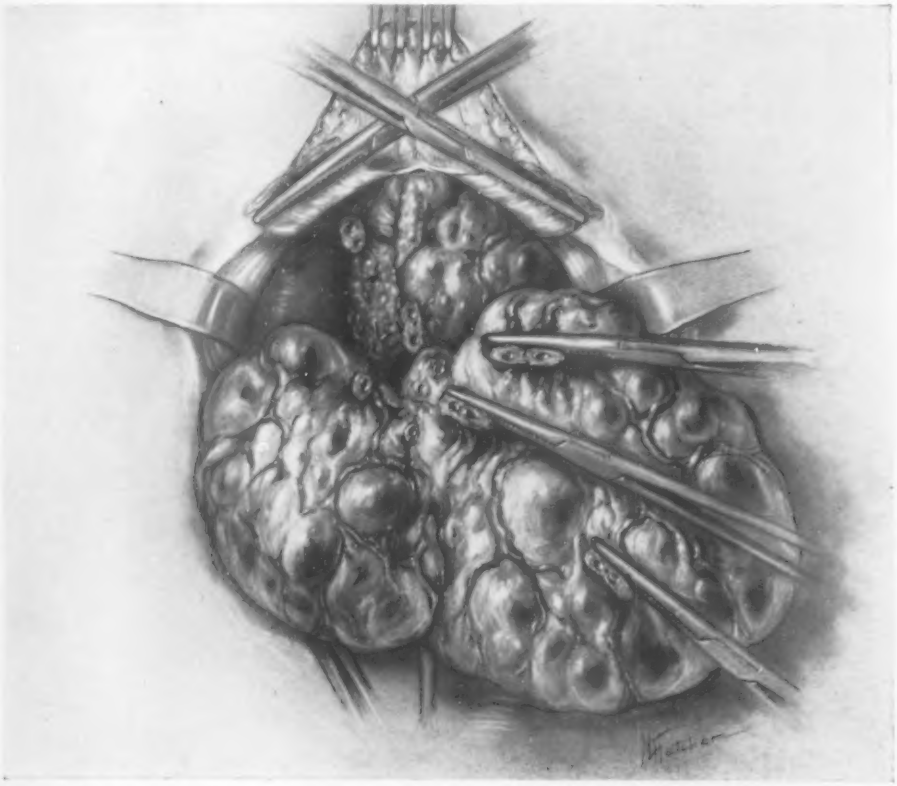

FIG. 5.—Primary mobilization of right superior pole. Right lobe and isthmus freed from trachea. Note substernal mass presenting into wound. Left lobe undisturbed.

extremely safe, for any disturbance with respiration during an operation for goitre may be charged to the surgeon's manipulation and not to the anæsthetic.

This excellent and valuable method of Pemberton's has not been generally adopted and the writer, who has employed it for five years in his work and realizes full well its value, wishes to call attention to it and urge its more general adoption.

THE EXPERIMENTAL PRODUCTION OF ABSCESS OF THE LUNG*

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and

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Abscess of the lung is a general term applied to a wide variety of suppurative conditions occurring within the lung. These conditions differ greatly in their mode of production, their morbid pathology and their response to

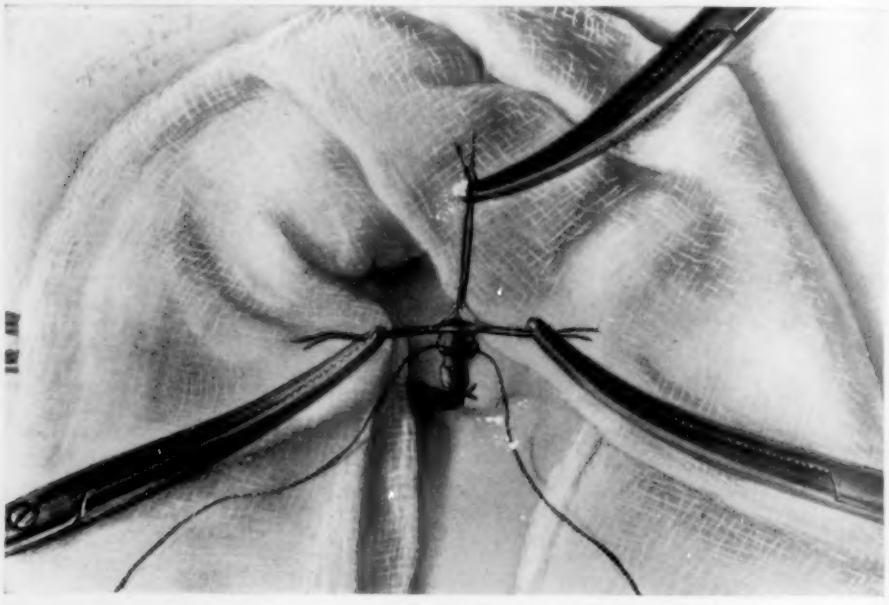

Fig. 1.—Segment of femoral vein tied at base and held open for the insertion of a piece of lead and the bacterial emulsion.

therapy. They enter into a common category merely because they occupy the same organ, and they differ as widely as do comparable conditions within the liver, such as amœbic abscess and the abscess of an ascending pylephlebitis. Certainly the post-pneumonic abscess, the bronchiectatic abscess, and the post-operative abscess of the lung have a quite dissimilar etiology. All of these varieties undoubtedly belong in one or the other of the two great pathological divisions of pulmonary suppuration, *i.e.*, endobronchial and parenchymatous suppuration. We feel, however, that further study of this subject from the

* Read before the American Surgical Association, May 26, 1926.

point of view of morbid pathology is less likely to give a full appreciation of the condition than an attempt at experimental reproduction.

The studies reported here concern solely *post-operative abscess of the lung*. They form part of a general study of post-operative pulmonary complications and were undertaken in the hope that further proof might be found for the concept that a large proportion of such complications are due to embolism from the operative wound. We have [1, 2] for ten years accepted the suggestion made in 1900 by Mikulicz [3] that embolism might be the cause of certain so-called post-operative pneumonias. He was led to this assertion by the occurrence of such complications following operations under cocaine anæsthesia. It is now generally accepted that, in addition to massive pulmonary embolism, certain of the other pulmonary complications, such as pleurisy and pneumonia, may have a similar etiology. Could we prove that post-operative abscess of the lung resulted from the same mechanism, considerable weight would be added to the explanation of these most serious operative sequelæ. Moreover, such a simplification, by bringing many complications within the limits of a single mechanism would forcibly indicate the lines along which these undesirable sequelæ might be avoided, since the blame for the complications would then rest squarely upon surgical technic and operative skill.

FIG. 2.—Segment of vein in glass cannula filled with salt solution about to be forced into the jugular vein.

We have been able to assemble from the literature 1908 cases of abscess of the lung. Of these 29.6 per cent. are post-operative, and 14.6 per cent., or approximately one-half, follow the operation of tonsillectomy. This frequency following tonsillectomy has resulted in the conception that abscess of the lung is a complication peculiar to this type of operation. Investigation does not substantiate this. The fact is that tonsillectomy is a very common operation and that abscess of the lung is a relatively infrequent post-operative complication. It follows the operation of tonsillectomy no more frequently than operations in any other septic field.

The apparent frequency of abscess of the lung following tonsillectomy was thought to be due to the special liability in this operation to aspiration of infected buccal content. It has long been known that during every general anæsthetic mouth contents are aspirated into the lung,[4, 5, 6] and in the case of tonsillectomy, with the operative field close to the respiratory orifice, the dan-

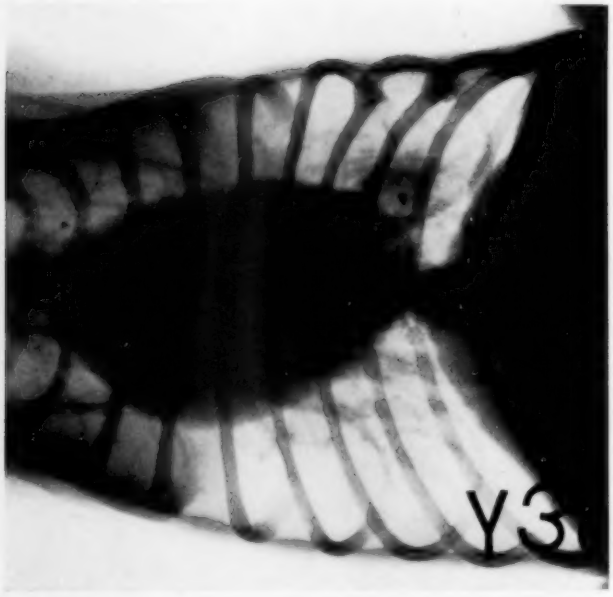

FIG. 4.—Röntgenogram of Dog Y 38—Experiment I, two days after embolism. There is beginning infiltration about the foreign body.

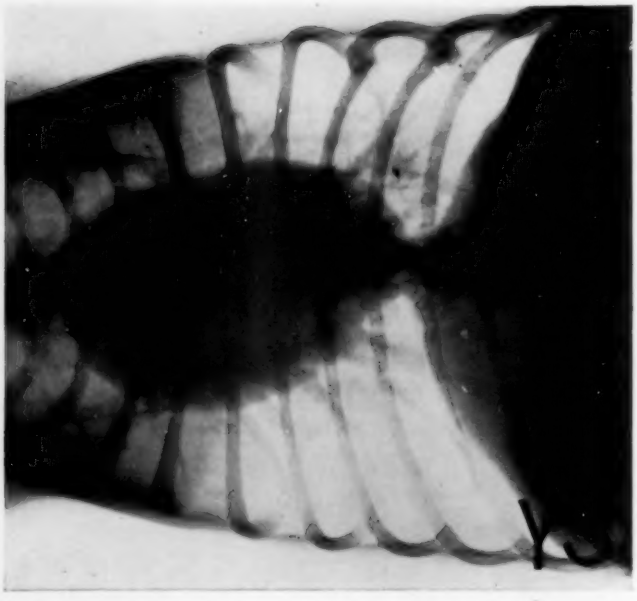

FIG. 3.—Röntgenogram of Dog Y 38—Experiment I, immediately after embolism. The piece of lead in the left lower lobe indicates the position of the embolus.

ger seemed too obvious. Moreover, the reports of such complications from operators working upon patients in the upright position [7] seemed to further justify this feeling. As a result of such reasoning, considerable investigative work has been done attempting to reproduce a similar pulmonary suppuration in animals,[8, 9, 10] Many kinds of bacteria, plugs of meat and foreign materials have been introduced into the lung by insufflation, by the bronchoscope and by various ingenious methods calculated to lead the infected material into the finer ramifications of the bronchial tree. So far as we can determine, no one has been able to reproduce in animals typical abscess of the lung by such methods.

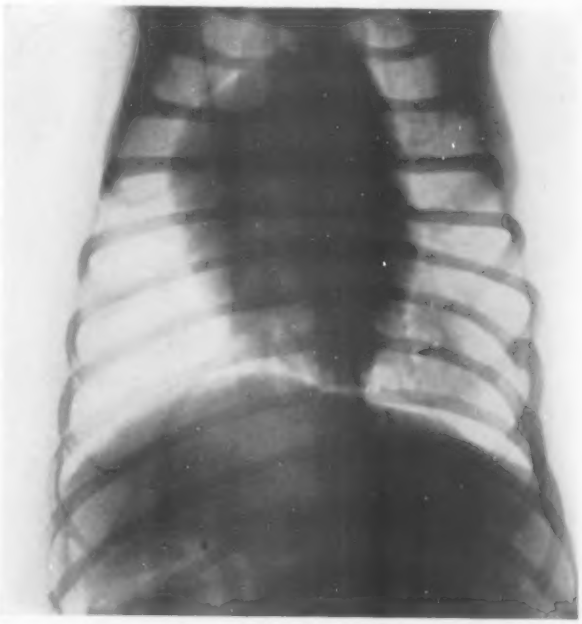

FIG. 5.—Röntgenogram of Dog Y 38—Experiment I, five days after embolism. A well-defined abscess cavity is present.

There is, moreover, another side to the problem. In the first place, post-operative pulmonary suppuration is not peculiar to the operation of tonsillectomy. Again this dire sequela follows upon tonsillectomy when the operation is performed under local anæsthesia.[11, 12] Further, the clinical history is not that of an immediate post-operative pulmonary upset. In fact, there frequently occurs a period of normal convalescence until, at a period seven to fourteen days post-operative, preceded by or synchronous with pleuritic pains, the symptoms of pulmonary disease commence and gradually are intensified. In addition there is the evidence that the endobronchial apparatus is well adapted to a defense against infection. Inspired foreign bodies rarely result in true pulmonary suppuration, though there may occur endobronchial irritation, infection and subsequent dilatation of that part of the air passages lodging the foreign body.[13] As further evidence of the great defensive mechanism within the bronchi, may we cite the following case:

E. T., forty-three, complained of dysphagia. The diagnosis of carcinoma of the œsophagus was made by direct visualization December 4, 1924. He was treated by the implantation of radium seeds. At the patient's request, gastrostomy was performed September 30, 1925. March 18, 1926, the patient commenced regurgitating by mouth food given via the stomach catheter. This was accompanied by paroxysms of coughing. This condition continued until his death April 29, 1926. Autopsy showed complete stenosis of the œsophagus and a fistula between the œsophagus just below this point and the left

primary bronchus; the left lung was clear; there was pneumonia in the right lower and middle lobes.

It seems established in this case that for at least five weeks the patient had a communication between his stomach and his left lung, and yet the left lung was unaffected.

We had long felt that evidence of this nature was sufficient to justify grave suspicion of the conception that aspiration was the cause of pulmonary suppuration. Knowing of the failure of the experimental work in which attempts have been made to reproduce abscess of the lung by the instillation of infected materials into the air passages, it occurred to us that post-operative abscess of the lung might well be of embolic origin as are many other post-operative complications.

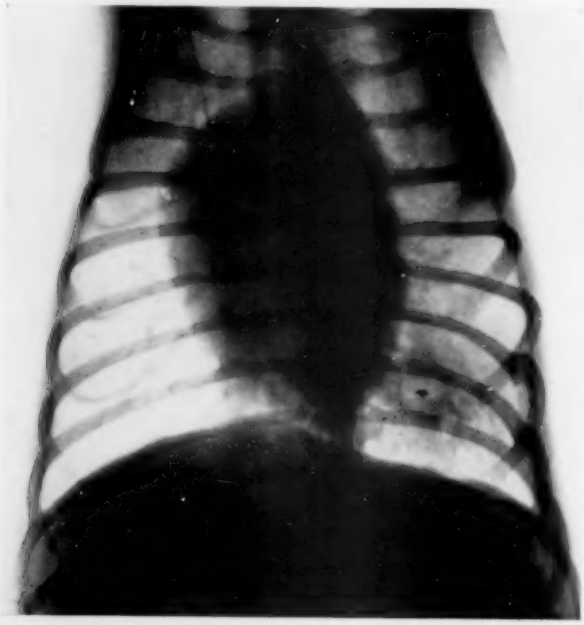

FIG. 6.—Röntgenogram of Dog Y 38—Experiment I, eight days after embolism. The abscess in the left lower lobe is distinct. The lead fragment lies in a clear central zone.

Before attempting to produce abscess of the lung by the use of infected emboli and in order to free ourselves of criticism by those who still hold to the theory that aspiration gives rise to this condition, we performed a considerable number of experiments in which we placed infected materials with a bronchoscope into the finer ramifications of the bronchial tree. We used pieces of infected meat, infected tonsil, peanuts, etc. In no one of the seventeen attempts could we reproduce typical abscess of the lung. This was not surprising to us because other investigators had failed previously in similar attempts.

A Method for the Production of Abscess of the Lung.[14]—We then attempted the production of abscess of the lung by the instillation of septic emboli. Dogs were used in these experiments, and once the procedure became standardized we were able to produce abscesses in 100 per cent. of our animals. During the early experiments we inserted into the jugular vein of the animals pieces of infected tonsil, infected meat, etc., and though we achieved some abscesses, it was frequently the result that an extensive pneumonitis of the lobe in which the embolism lodged was produced. This rapidly broke down and often perforated into the pleural cavity resulting in death. We

felt that, though it was necessary to have the correct number and type of organisms present, it was equally necessary that some sort of local immunity be produced in the pulmonary tissue before the majority of the organisms were set free. It seemed to us simpler to set up a temporary artificial barrier about the infected embolus than to raise beforehand the defense reaction in the pulmonary field. The procedure, which finally became standardized as the most satisfactory for the production of abscess of the lung, consisted in constructing an embolus of a segment of vein (Fig. 1) which was filled with a culture of the desired organisms. We excised a small segment of the femoral vein, ligated one end, filled this capsule with the organisms and added a piece of lead filing coated with paraffin to render it inert. This bit of metal enabled us to recognize in immediate röntgenograms the site where the embolus lodged. After tying off the other end of this small capsule it was set free in the jugular or femoral vein (Fig. 2). In over sixty per cent. of our experiments the embolus lodged in the left lower lobe, due, we believe, to the straighter course of the vessel and the greater volume of blood going to this lobe. This course was taken, therefore, for the

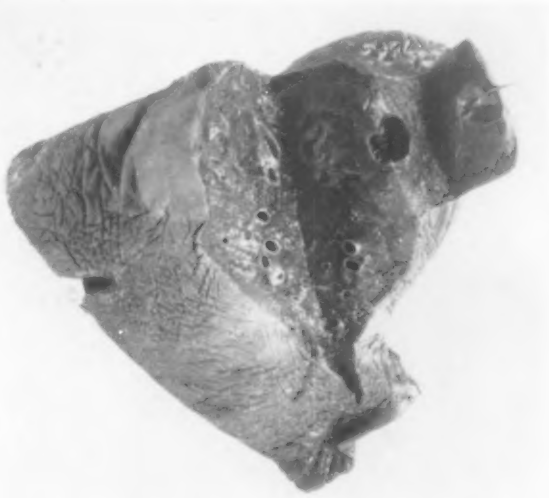

FIG. 7.—Left lower lobe removed from Dog Y 38—Experiment I, sixteen days after embolism. A small abscess is still present.

FIG. 8.—Lungs removed at necropsy from Dog I (normal control) thirty-six hours after the intravenous injection of a clot infected with virulent B. coli organisms. The left lower lobe is quite densely consolidated.

same reason that directs the lodgement of emboli in human cases, where the majority go to the right lower lobe.

The following experiment is typical of the series, and serves to illustrate the simplicity of the procedure:

Protocol.—Experiment I.—Dog Y 38, weight 12.1 kg., November 11, 1925 was given morphin, gr. ¼. Under ether anæsthesia, a segment was removed from the right femoral vein, inoculated with cultures of staphylococcus aureus, B. coli and pneumococcus, type II, and introduced into the left jugular vein. A röntgenogram localized the foreign body in the left lower lobe, Fig. 3.

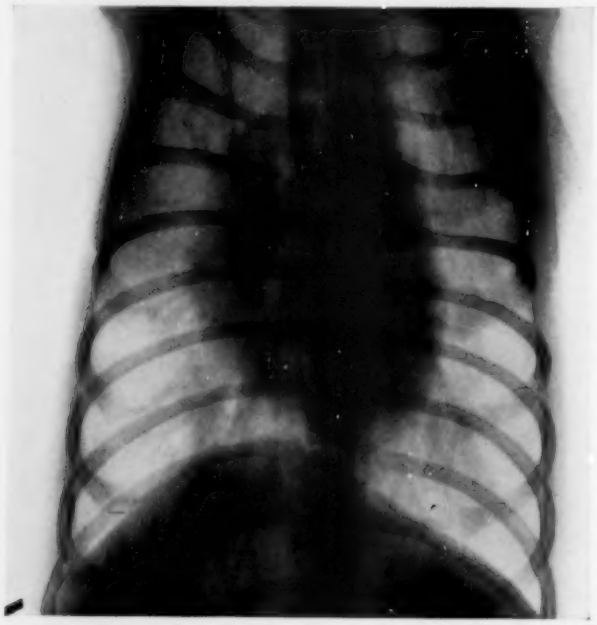

FIG. 9.—Röntgenogram of Dog II, fifty-four hours after the intravenous injection of a clot infected with virulent B. coli organisms. There is a beginning consolidation of the right lower lobe.

November 13, 1925.—According to the röntgenogram there was beginning infiltration about the foreign body, Fig. 4. The animal ate his food well.

November 16, 1925.—A röntgenogram of the chest showed a definite abscess cavity in the left lower lobe where a clear zone containing the bit of lead appeared in the centre of the infiltrated area, Fig. 5. The animal ate only a small amount of food.

November 19, 1925.—The abscess cavity in the left lower lobe was larger. The surrounding infiltration of the lung remained about the same, Fig. 6.

November 27, 1925.—Subsequent röntgenograms of the chest had shown a subsidence of the infiltration and the abscess cavity had decreased considerably in size. The left lower lobe was removed by operation. In the removed lobe an area of induration could be felt near the tip of the lobe. The overlying visceral pleura was considerably thickened. On section, thick indurated tissue was encountered within which a small abscess cavity was still present, Fig. 7. Microscopically, the lining of the cavity was composed chiefly of fibrous tissue. Considerable cell exudation was still present.

Discussion.—By this method of freeing infected emboli into the venous circuit, we have been able to produce true abscess of the lung. Such an abscess starts as a parenchymatous lesion. Its establishment depends undoubtedly upon many factors. Under the circumstances imposed by us in our experiments, the type of organism present and the physical property of the covering of the embolus seem to be of some importance. We found that freeing a simple infected and *uncovered* clot into the venous circuit usually resulted in a general pneumonitis rather than a walled-off abscess. It would seem as if the covering of the venous segment permitted the establishment

of a walling-off process before the full effect of all the organisms in the capsule was produced. Or the influence of the venous segment as an organic foreign body may be of importance. Possibly this means that the actual physical make-up of any single infected embolus may play a dominant rôle as to whether abscess of the lung is or is not to result. It is conceivable that clots of variable structure and infectivity may be set free from the operative field. Those clots, in which the majority of the organisms are centrally located, and in which the clot has an unusually tough peripheral coat, should be more likely to cause an abscess.

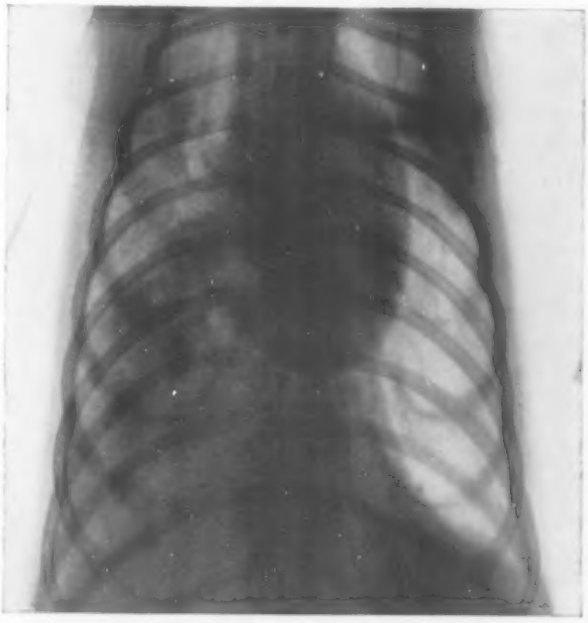

FIG. 10.—Röntgenogram of Dog II, seventy-two hours after the intravenous injection of a clot infected with virulent B. coli organisms. The right lower lobe is densely consolidated.

It would seem, however, that such an explanation could apply to only a limited number of actual cases. This necessitated further study concerning the mechanism by which local tissue immunity might be produced. It was apparent that there must be present some factor which tended to keep the process well localized. Unless a clot was so constructed that it had a tough outer coat, that factor must deal with local tissue immunity. We felt that, if we could raise the local immunity of an animal by vaccination with an organism to be used later in an infected thrombus, we might well establish a high local immunity which would restrain spreading of organisms from the local field, bring about an intense local resistance, and thus create an abscess. Moreover, as post-operative abscess of the lung occurs in cases already infected and thus already immunized, it would appear that such experiments would more nearly reduplicate what actually occurs in human cases. The following protocols of experimental and control animals demonstrate the proof of these contentions.

Experimental Studies of the Rôle of Local Immunity in the Production of Abscess of the Lung.—Four animals were comprised in each experiment. One animal was used as a normal control, one was immunized by injecting an avirulent strain of B. coli intravenously, one animal had small sterile emboli (starch granules) set free in the jugular vein in an attempt to see if non-infectious material would also create high local resistance, and the fourth

animal was submitted to an abdominal operation (lateral intestinal anastomosis) in an effort to see whether such a procedure would bring about a definite general immune reaction sufficient to create local pulmonary resistance and thus wall off the subsequent pulmonary infection. We felt that we covered the major possibilities for the establishment of a high local resistance in the lung with the normal control, the pre-operative aseptic embolic control and the simple operative control animals. When these animals had been sufficiently prepared they were submitted to embolism.

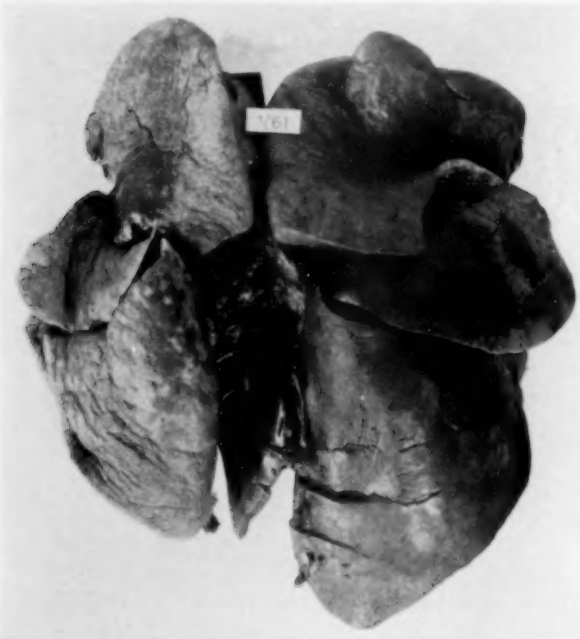

FIG. 11.—Lungs removed at necropsy from Dog II, seventy-two hours after the intravenous injection of a clot infected with virulent B. coli organisms. The right lower lobe is densely consolidated.

The embolus was prepared as follows: A virulent strain† of B. coli was obtained, grown on an agar slant, and the culture washed off with salt solution and thoroughly shaken; blood was drawn under aseptic precautions, the suspension of B. coli at once added and the tube thoroughly shaken to ensure equal mixing before clotting. The whole was then allowed to clot and eighteen hours later the clot was carefully divided into four equal parts and the clot slipped into the jugular vein of all four animals. Each fragment of clot was roughly 10 x 4 mm. in size.

The experimental work dealing with this phase of the question is not sufficiently complete to permit us at this time to give final reports and full proof of our ideas regarding the rôle of local tissue immunity and the method of its production. We have, however, sufficient experimental evidence to strongly indicate that the establishment of such a local immunity plays a dominant part in the production of abscess of the lung using the method described above.

Before reporting such experiments may we repeat the following facts: (1) simple infected clots set free in the jugular vein of dogs usually give rise to a diffuse pneumonitis which will result in fatality or recovery, according

† Secured from Dr. B. Steinberg of the Department of Pathology, Western Reserve University. This organism was of sufficient virulence to kill a dog in six hours by the intraperitoneal injection of one washed agar slant mixed with gum tragacanth.

to the virulence of the organism; (2) an infected embolus enclosed in a capsule (segment of vein) will result in an abscess of the lung.

Protocol—Experiment A.—Dog I (normal control), weight 16.9 kg., May 15, 1926, was given morphin, gr. ¼. Under novocain anæsthesia the left jugular vein was exposed, opened and the eighteen hour clot infected with the virulent B. coli organism was introduced.

May 16, 1926.—Twenty-four hours after the injection of the clot the dog appeared ill and would not eat. The respiratory rate was so rapid that an X-ray plate of the chest could not be taken. It was noticed that at times the dog would cough and bring up a frothy, bloody sputum. The rectal temperature was 41.3° C.

May 17, 1926.—The dog died thirty-six hours after the injection of the infected clot.

Necropsy.—There was considerable cloudy hemorrhagic fluid in the left pleural cavity. The lungs showed some congestion at the right lower base; otherwise the lobes on the right side were air-containing and apparently normal. The left upper lobe showed some congestion. The left lower lobe was quite densely consolidated, Fig. 8. On section the cut surface of this lobe was of a deep reddish color (red hepatization stage of pneumonia).

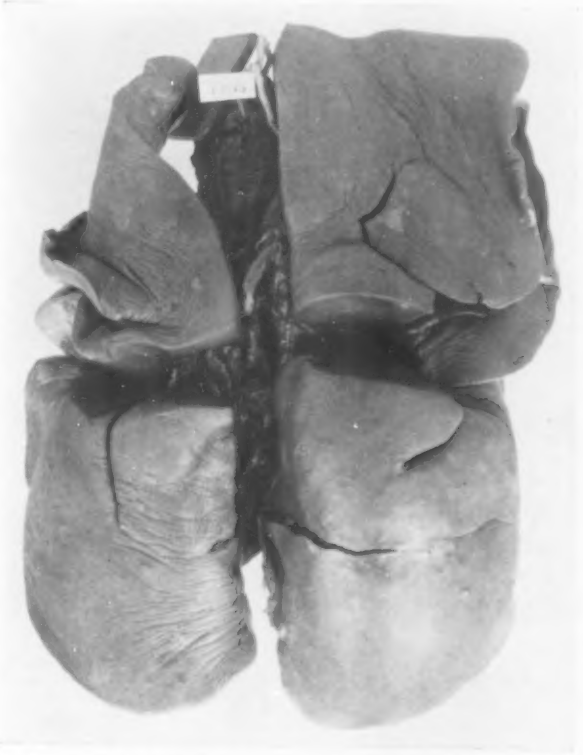

FIG. 12.—Lungs removed at necropsy from Dog III, eighteen hours after the intravenous injection of a clot infected with virulent B. coli organisms. The right lower lobe is consolidated. The right upper and middle lobes and the left lower lobe show some congestion.

Dog II (bacterial immunized control), weight 8 kg., May 15, 1926, was given morphin, gr. ¼. An attempt had been made to immunize this animal by injecting intravenously a platinum loopful of avirulent B. coli organisms suspended in 10 c.c. of salt solution. Three injections at intervals of two days had been carried out ten days previously. The left jugular vein was exposed under novocain anæsthesia, opened, and the eighteen hour clot infected with the virulent B. coli organism was introduced.

May 16, 1926.—The dog ate most of his food and did not appear ill although his temperature was 39.7° C. A röntgenogram of the chest showed normal lung fields.

May 17, 1926.—The dog ate his food. The rectal temperature was 39.9° C. A röntgenogram of the chest was taken in the morning. The lung fields appeared quite normal. Another röntgenogram of the chest was taken in the late afternoon and showed a beginning area of cloudiness in the right lower lobe, Fig. 9.

May 18, 1926.—When seen about 9 A.M. the dog was in extremis. The respiratory

rate was very rapid and the rectal temperature was 40° C. A röntgenogram of the chest just preceding death showed a dense cloudiness of the entire right lower lung, Fig. 10.

Necropsy.—There was a slight amount of purulent hemorrhagic fluid in the right pleural cavity. The left lung appeared normal. The right upper and middle lobes showed some congestion but were air-containing. The right lower lobe was densely consolidated and cut with resistance, Fig. 11. The cut surface of this lobe presented a deep reddish color. There was no localized abscess present. The animal had apparently established some degree of immunity which was, however, not sufficient to prevent the diffuse lower lobe infection. It is interesting to note, however, that this animal, a smaller animal than the normal control, was able to withstand the infection for a greater period of time.

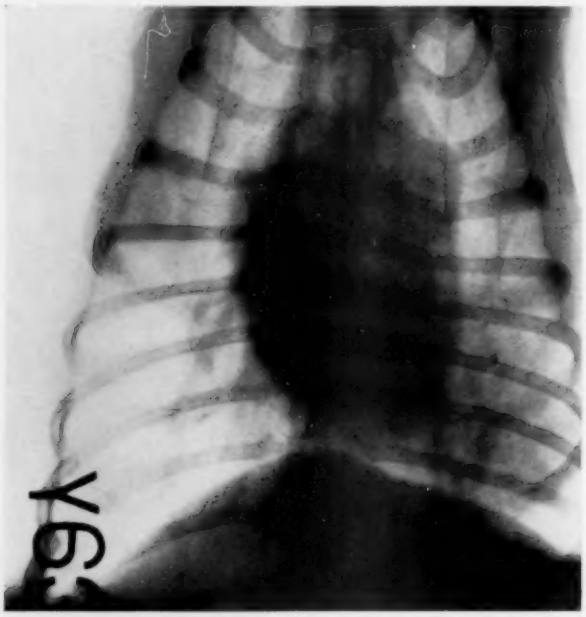

FIG. 13.—Röntgenogram of Dog IV, forty-eight hours after the intravenous injection of a clot infected with virulent B. coli organisms. The left lower lobe shows a diffuse cloudiness.

Dog III (pre-operative aseptic embolic control), weight 10 kg., May 15, 1926, was given morphin, gr. ¼. This animal had had three intravenous injections at intervals of two days of 10 c.c. of starch solution ten days previously. Under novocain anæsthesia the left jugular vein was exposed, opened, and the eighteen hour clot infected with the virulent B. coli organism was introduced.

May 16, 1926.—The animal died about eighteen hours following the injection.

Necropsy.—There was a slight amount of cloudy hemorrhagic fluid in the right pleural cavity. The left lower lobe showed some congestion but otherwise the left lung was air-containing. The right upper and middle lobes showed a moderate degree of congestion. The right lower lobe was densely consolidated and there was a slight amount of exudate on the visceral pleura, Fig. 12. On cut section the lobe showed numerous grayish patches, but a reddish color was predominant.

Dog IV (simple operative control), weight 16.9 kg., May 15, 1926, was given morphin, gr. ¼. This animal had been submitted to an abdominal operation (lateral intestinal anastomosis) two days previously. Under novocain anæsthesia the left jugular vein was exposed, opened, and the eighteen hour clot infected with the virulent B. coli organism was introduced.

May 16, 1926.—The dog appeared somewhat ill but ate part of his food. The rectal temperature was 40.5° C. A röntgenogram of the chest showed an indefinite area of cloudiness in the left lower lobe.

May 17, 1926.—The animal ate a part of his food. The respiratory rate was definitely increased and it was noticed that the dog coughed occasionally. The rectal temperature was 40.7° C. A röntgenogram of the chest showed a definite area of mottled cloudiness in the left lower lobe, Fig. 13. A röntgenogram taken late in the afternoon showed an even greater area of cloudiness in the left lower lobe.

May 18, 1926.—The animal continued ill but ate some food. The rectal temperature

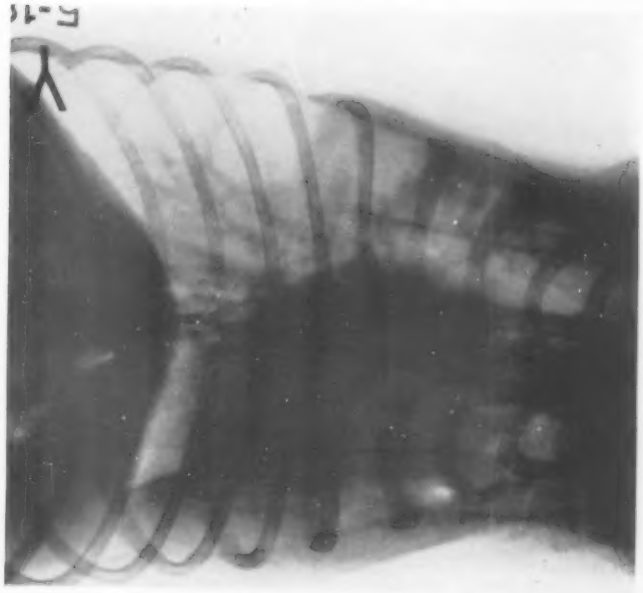

FIG. 14.—Roentgenogram of Dog IV, seventy-two hours after the intravenous injection of a clot infected with virulent B. coli organisms. The left lower lung casts a dense shadow.

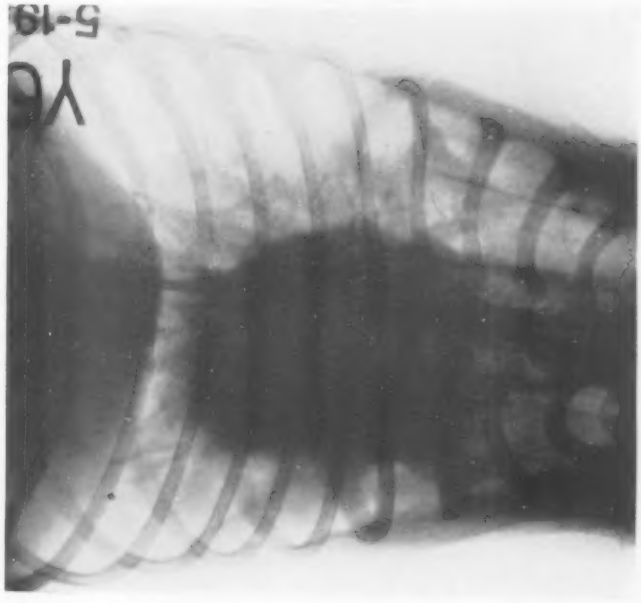

FIG. 15.—Roentgenogram of Dog IV, ninety-six hours after the intravenous injection of a clot infected with virulent B. coli organisms. The left lower lobe shows less infiltration with areas of lessened density.

was 38.9° C. A röntgenogram of the chest showed an even greater area of consolidation of the left lung, Fig. 14.

May 19, 1926.—The animal's general condition seemed improved. The rectal temperature was 40° C. A röntgenogram of the chest showed the area of cloudiness in the left lower lung to be less dense but there were numerous areas of lessened density suggestive of abscess formation, Fig. 15. It was decided to remove the left lower lobe by operation. At operation numerous friable adhesions plastered the left lower lobe to the lateral chest wall and to the adjoining upper lobe. These were easily broken down and the lobe was removed. The removed lobe was consolidated throughout except for a small area near the tip which was air-containing. The lobe was of a dark red color and presented numerous areas of grayish exudate on the visceral pleura beneath which areas of softening could be felt. Near the hilus of the lobe there were several areas of broken down lung tissue, Fig. 16. The lobe was sectioned and several small abscesses were encountered containing thick whitish pus. Near the hilus of the lobe a fairly large abscess cavity was encountered approximately 1 cm. by 3 cm., Fig. 17.

FIG. 16.—Left lower lobe removed at operation from Dog IV, ninety-six hours after the intravenous injection of a clot infected with virulent B. coli organisms. The lobe is quite solid and numerous areas of exudate present on the visceral pleura beneath which are areas of softening.

Discussion.—The above experiment demonstrates facts that have been corroborated repeatedly in this laboratory. In the first place, virulent infected clots set free in the venous circuit result in fatal pneumonitis. Histological examination shows a process identical with true lobar pneumonia. In the second place, immunization with avirulent organisms or by previously operating upon the animal in a field where organisms are already present (the intestines) yields a varying degree of protection. Both Dog II (bacterial immunized control) and Dog IV (operative control) outlived Dog I (the normal control animal). Aseptic emboli seem to instigate insufficient immunity to affect the outcome (Dog III). In this particular experiment, the normal control animal (Dog I) survived eighteen hours, the bacterial immunized control animal (Dog II) survived seventy-two hours and the operative control animal (Dog IV) was apparently recovering when lobectomy was performed. Abscess of the lung resulted only in Dog IV. We feel that this indicates that abscess results when immunity

has been sufficiently stimulated. The fact that Dog IV outlived Dog II indicates that immunity reactions were more highly stimulated.

These experiments will be elaborated upon and repeated, but even the single group reported would seem to indicate that in the establishment of post-operative abscess of the lung the two factors of *embolism from the wound* and *the local immune reactions in the lung* play dominant rôles. The type of organism present, the physical character of the clot, immunity established by previous infection with similar organisms, the presence of organic matter other than simple clot in the embolus, and the number and virulence of both pathogenic and saprophytic organisms within the bronchial passages themselves may play a variable part.

FIG. 17.—Appearance of the lobe removed from Dog IV, after sectioning. One fairly large abscess can be seen near the hilus.

Why such lesions in dogs tend to heal within two weeks unless they kill in the first few days seems to be explained (1) by the horizontal plane of the dog's bronchial tree enabling freer drainage than in man and (2) by the fact that animals have, because of more frequent exposure, a far higher resistance to all infection.

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THE OCCURRENCE AND MANAGEMENT OF GASTROJEJUNAL ULCER*

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Recurrence of ulceration may follow any operation for peptic ulcer including partial gastrectomy. Many factors are worthy of consideration as the cause of these recurrences, but in the individual case it is seldom that such possible causes can be established. It is, however, becoming increasingly apparent that a certain type of individual, the hypertonic, is particularly prone to recurrence of ulceration. The tendency of such recurrent lesions to localize at, or near, the site of a gastro-enterostomy is well known, and their clinical recognition is one of the outstanding advances in diagnosis in recent years. The diagnosis of these gastro-jejunal ulcers by röntgen-ray is not as positive as it is of other lesions of the stomach or duodenum, and a negative report is of relatively minor value in a case with a clear-cut clinical history. The course of gastrojejunal ulcer is more definitely progressive (particularly in the disability of the patient) than that of a primary ulcer and it is subject to the same complications, except that malignant degeneration has not been reported. The treatment of gastrojejunal ulcer is surgical, and it is this phase of the subject I wish to discuss.

This presentation is based on a series of 270 cases of gastrojejunal ulcer operated on in the clinic. In 139 of these the original operation for ulcer had been performed in the clinic, and in 131 it had been performed elsewhere. Gastro-enterostomy has been performed for peptic ulcer more than 8600 times in the clinic, so that the total percentage of gastrojejunal ulcers is 1.6. This percentage is approximately the same as that reported from many of the larger clinics, particularly those of Moynihan, Sherren, and Walton. The average age of the patients with gastrojejunal ulcer was forty-two, the oldest being seventy-four, and the youngest fifteen.

The incidence of males and females is interesting, since it is a fact that gastrojejunal ulcer occurs rarely in women. In this series there were 248 males and twenty-two females, a ratio of 10 to 1, while the ratio of primary peptic ulcer encountered in men and women is 3.5 to 1.

Again it is shown that the likelihood of gastrojejunal ulcer following gastro-enterostomy for duodenal ulcer is considerably greater than following gastro-enterostomy for gastric ulcer. Because of incomplete information as to those patients operated on elsewhere, we can only judge the relative liability by our own cases. Of those cases in which gastro-enterostomy was performed at the clinic, gastrojejunal ulcer followed an operation for duodenal ulcer in 130 and followed operation for gastric ulcer in only nine. While this ratio is 15 to 1, the ratio between the number of cases in which gastro-enterostomy

* Read before the American Surgical Association, May 24, 1926.

was performed for duodenal ulcer and those in which it was performed for gastric ulcer is 7 to 1.

The acid values of the gastric contents in cases of gastrojejunal ulcer as compared to the acid values before gastro-enterostomy are usually, but not always, of significance. In 40 per cent. of this series of cases of gastrojejunal ulcer the free hydrochloric acid was either increased or very slightly reduced by the gastro-enterostomy; but in 40 per cent. there was a marked reduction, and in 20 per cent. the free hydrochloric acid was reduced to zero. The fact that there was no free hydrochloric acid in one-fifth of the cases of gastrojejunal ulcer in which repeated and fractional examinations of the gastric contents were made, disproves the assumption that achlorhydria following the primary operation affords protection against later ulceration.

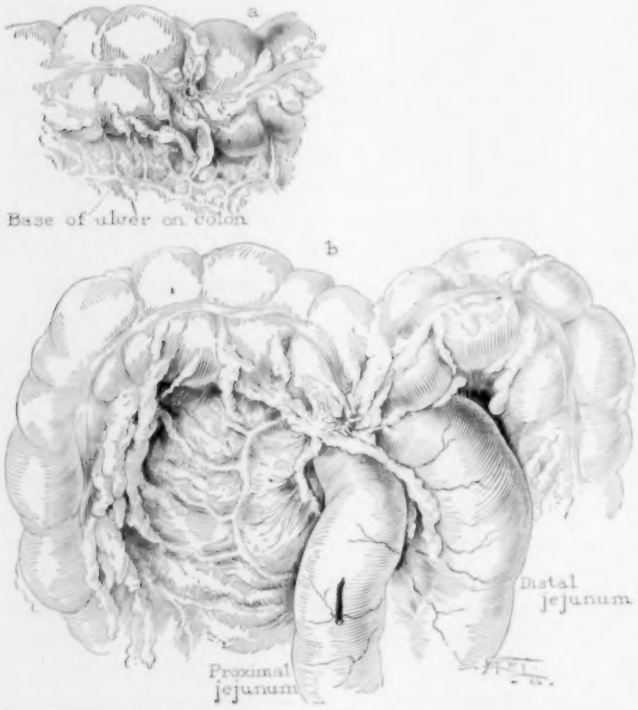

FIG. 1.—Illustrating how inflammation of the surrounding structures may obscure a gastrojejunal ulcer.

Perforation, either chronic, subacute or acute, characterizes all gastrojejunal ulcers and involves first in frequency the mesocolon and adjacent peritoneal folds, next the colon, and thirdly the abdominal wall.

The average length of time between the operation for the primary ulcer and that for the gastrojejunal ulcer was four and a half years in this series. In 56.7 per cent. of the cases symptoms suggestive of recurrence appeared within the first year. There were, however, a number of cases in which symptoms did not recur for a considerably longer period, in one instance about twelve years. Such long periods before the recurrence are exceptional.

The indications for management are clear. Experience emphatically teaches that when the symptoms are those of recurring ulceration, when the röntgenogram is positive, and when relief of symptoms cannot be promptly attained and maintained by medical treatment, early operation is the safest and most satisfactory method of management.

The conditions found at exploration will determine the best procedure to

be followed. It may always be assumed that a well-placed anastomosis has brought about the healing of a duodenal ulcer. If such healing has taken place without producing any obstruction at the pylorus, and if examination of the duodenum and pyloric end of the stomach seems to show that it will maintain adequate drainage of the stomach, the simplest and most rational procedure to employ is the disconnection of the anastomosis and the excision of the gastrojejunal ulcer. When such an operation can be performed, it must be looked on as the operation of choice, and it has the very great merit of its conservatism. The patient should, in his habits of living following operation, endeavor to prevent possible reactivation of the ulcer, and if such reactivation should occur, he should be informed of the advisability of radical operation.

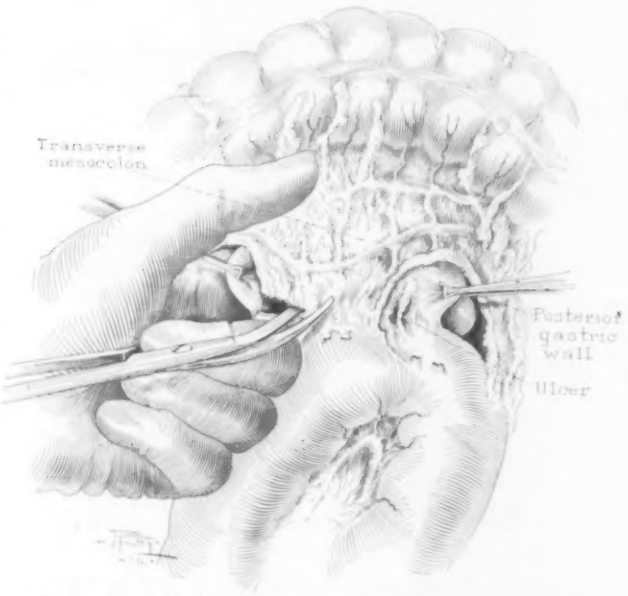

FIG. 2.—Method of freeing the mesocolon from its attachments.

It is more often true, however, that although the original ulcer has healed, it has healed with such extensive scarring, or so much deformity has resulted from previous operations on the pylorus that the latter is incapable of carrying on its normal function, and an operation as simple as the disconnection of the anastomosis is, therefore, unwise. When this simple operation can not be performed the operation of election, from the standpoint of immediate and late results, is the disconnection of the anastomosis with excision of the ulcer and partial gastrectomy.

When either the simple or more radical operation is contraindicated, one of the many other procedures may be substituted. Of such procedures the first in merit is the disconnection of the anastomosis, excision of the ulcer, and an operation at the pylorus to provide for adequate drainage. When satisfactory drainage has been secured the results have been often completely satisfactory, but they are also uncertain; and in my opinion the indications for this procedure are becoming less and less frequent. An important point in the technic of such operations, whether they be of the pyloroplasty type or whether a Billroth I (removing only a small part of the pyloric end of the stomach), is to fix the reconstructed pyloric outlet to the right of the median line by a stay suture between the anterior wall of the stomach and the round ligament of the liver, as suggested by W. J. Mayo.

Other procedures which are more rarely performed because of their uncertain results, and only under most unusual circumstances, are: (1) excision of the ulcer and a plastic operation on the gastro-enteric stoma when the ulcer is small and the stoma large, well situated, and free from mesocolic attachments; (2) a second gastro-enterostomy when technical difficulties apparently prohibit mobilization of the anastomosis; (3) the disconnection of the anastomosis with excision of the ulcer and a second gastro-enterostomy in cases in which the original gastro-enteric stoma is so small or so placed that it is quite incapable of functioning; (4) partial gastric exclusion after the method of Devine, when the gastro-enteric anastomosis seems capable of carrying on function, and (5) jejunostomy as recommended by Moynihan. All these procedures are uncertain in their results and are only to be considered when other methods are contraindicated. It can safely be said, therefore, that with the exception of the simple disconnection of the anastomosis the best surgical treatment for gastrojejunal ulcer is partial gastrectomy and that the various operations which have been described are to be employed only when there are definite contraindications to resection of the stomach.

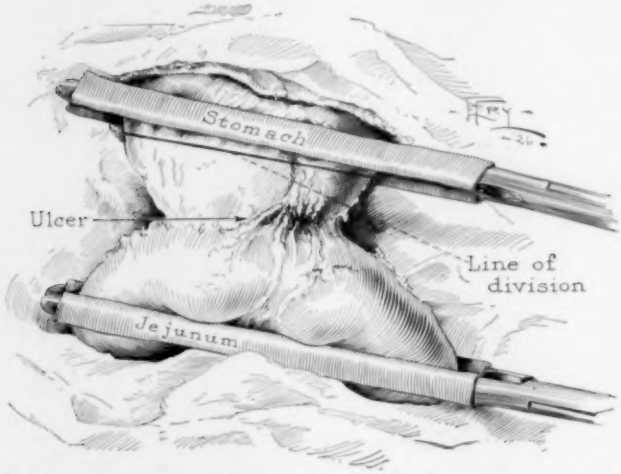

FIG. 3.—Application of clamps to stomach and jejunum on each side of the anastomotic ulcer.

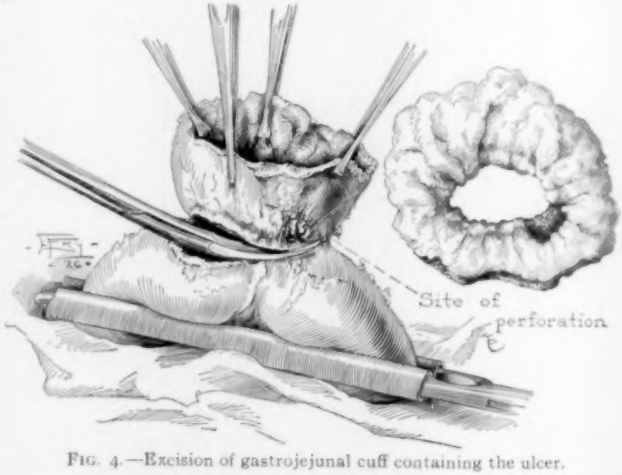

FIG. 4.—Excision of gastrojejunal cuff containing the ulcer.

Up to April, 1926, at the Mayo Clinic we have performed partial gastrectomy for uncomplicated gastrojejunal ulcer in eighty-nine cases with death in three, a mortality rate of 3.37 per cent. This mortality rate is not excessive in view of the frequently formidable nature of the operation, the condition of the patient, and the excellent results which follow the operation. The most

common and unfortunately the most serious complication of gastrojejunal ulcer is the formation of a gastrojejunocolic fistula. Such a complication adds to the difficulty and risk of the operation. It is actually an unnecessary complication since there is always evidence of the ulcer long enough before the development of the fistula for adequate surgical treatment to be instituted.

The success of partial gastrectomy for gastrojejunal ulcer does not depend alone on its technical perfection. In the first place the value of observation in the hospital before operation cannot be overstressed. In a previous article I have pointed out the advantages of preoperative treatment in this type of case.† Because of long continued dietary restrictions, pain, loss of sleep, and worry, many of the patients exhibit malnutrition to a serious degree. The disability in some cases is complete, and these patients are greatly benefited by a few days in the hospital, during which time they rest in bed and receive a bland diet and fluids in sufficient quantity to overcome the dehydration. Such measures are particularly beneficial when recent hemorrhage, exacerbation of inflammatory products, or retention have occurred. Not only is the general condition of the patient improved, but the activity of the lesion itself and the inflammatory reaction associated with it are reduced.

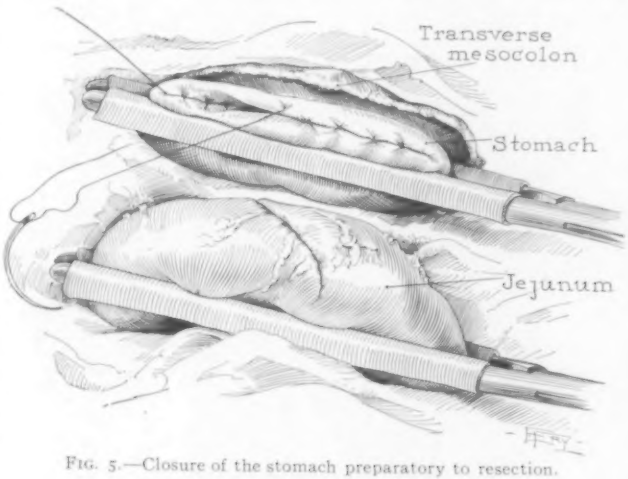

FIG. 5.—Closure of the stomach preparatory to resection.

In the case of an uncomplicated gastrojejunal ulcer partial gastrectomy can usually be conducted in a very precise manner: each step in the operation should be completed before subsequent steps are undertaken. It is hardly necessary to say that one should make as complete an exploration of the abdomen as is possible; although, when several operations have already been performed, detailed exploration involving extensive dissection is unwise because of the time consumed and the trauma inflicted.

The first step in the operation is the mobilization of the stomach. It is usually advisable to approach the anterior wall of the stomach and free it from its usual attachments to the abdominal wall in the region of former incisions, and to the liver. The pylorus is then exposed and also the duodenum, whenever advisable, to determine the extent of pathologic changes there. The

† Balfour, D. C.: The Value of Coöperation between Internist and Surgeon in the Management of Complicated Gastric Conditions with some Remarks on Partial Gastrectomy. Jour. Am. Med. Assn., 1925, vol. lxxxiv, pp. 876–879.

examination of the stomach should be most thorough in order to exclude the presence of a gastric ulcer at a higher point than the line on which the stomach will be resected. The colon and the great omentum are then mobilized and the gastro-enteric anastomosis brought into view. The anastomosis is then inspected for ulceration or for signs of irritation. These can usually be immediately detected and are most commonly seen in the anterior aspect of the anastomosis. In the majority of cases the site of the inflammatory process is at either the proximal or the distal extremity of the anastomosis. The mesocolon is invariably involved in this inflammatory process, and in many cases the inflammatory thickening in the mesocolon and gastrocolic omentum completely obscures the lesion (Fig. 1.) The separation of the anastomosis and the excision of the ulcer are very much facilitated if the entire anastomosis can be satisfactorily mobilized before one attempts to separate the jejunum from the stomach. An ulcer in the line of anastomosis is characteristically of the perforating type, the base of the lesion often being found in the surrounding fat of the mesocolon or gastrocolic omentum, the mesentery of the jejunum, or the wall of the colon. A very useful method which applies apparently, to all cases, particularly to the more difficult ones, is to expose the posterior wall of the stomach at some point near the anastomosis and by finger dissection to free the posterior wall of the stomach from its mesocolic attachments. This makes it more feasible to lift the mesocolon from the stomach anteriorly by blunt dissection until the edge of the mesocolon can be dissected by knife from its attachment (usually the anastomosis) (Fig. 2). After the mesocolon has been separated from the stomach, the segment of stomach is drawn down through the opening in the mesocolon and a rubber covered clamp placed across this segment of stomach 4 or 5 cm. from the site of the anastomosis. Likewise, the jejunum having been mobilized by the above dissection, a

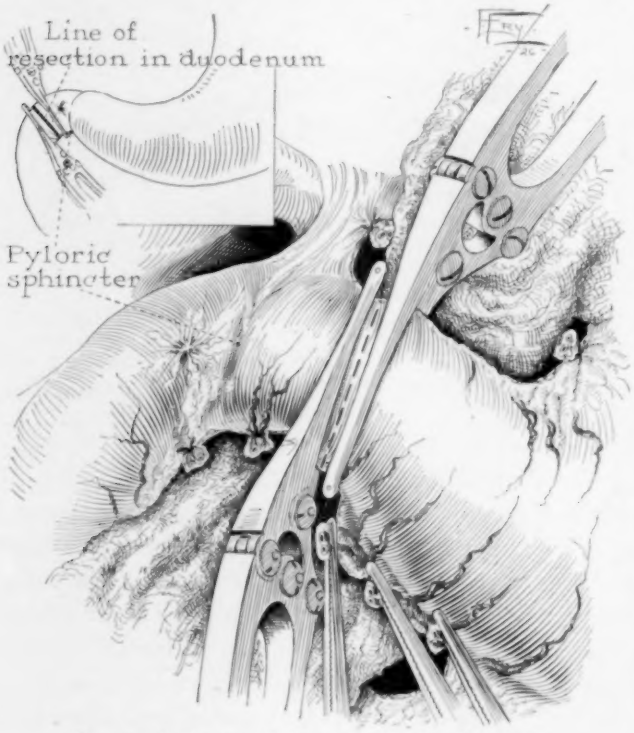

FIG. 6.—Application of clamps for resection of stomach.

rubber-covered clamp is placed across its two limbs and a gauze pack placed behind the anastomosis (Fig. 3).

A very useful way of demonstrating the exact site and size of the ulceration is to divide the stomach 2.5 cm. from the anastomosis. The resulting cuff of stomach can then be turned back upon itself and the whole line of the anastomosis is seen before it is damaged. If the ulcer is in the suture line or close to it, either in the stomach or the jejunum, the anastomosis with the cuff of the stomach attached to it can be excised, the ulcer being excised with this cuff (Fig. 4). If the ulcer is in the jejunum at some distance from the anastomosis it is not necessary to excise it, since healing apparently takes place promptly when the anastomosis is disconnected, and if the new union is made distal to the lesion. The defect in the jejunum is then closed in a transverse direction with chromic gut. As a matter of convenience the opening in the stomach is closed with a running suture of chromic catgut and the stomach is resected in the usual way (Fig. 5). It is important in the resection to avoid extensively scarred areas of the duodenum by beginning the resection sufficiently far above the pylorus for the pyloric stump to be easily closed (Fig. 6). The stomach is then mobilized by a division of the gastrocolic and the gastrohepatic omentum to a point high enough to permit of the removal of a sufficiently large portion of the stomach. A rubber-covered clamp is then placed across the stomach, parallel to the longitudinal axis of the body, 2.5 cm. above the site of the division. It is an important feature at this stage to place the clamp lightly enough not to injure the mucosa. I have had one case in which I am convinced that clamp caused enough damage to the mucosa to prevent healing, and a large ulcer formed which subse-

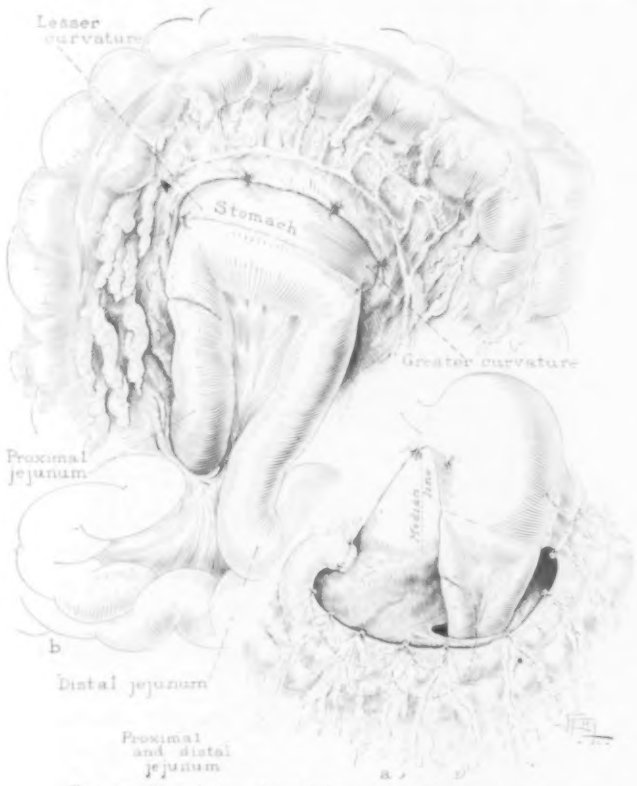

FIG. 7.—Completion of posterior end-to-side anastomosis.

quently perforated against the diaphragm and necessitated an operation for the removal of this recurring ulcer.

If the resection is not too extensive and the remaining segment of the stomach is not fixed by adhesions, a posterior end-to-side anastomosis is probably the operation of choice (Fig. 7). It is frequently found difficult, however, to arrange a posterior anastomosis properly below the mesocolic opening, and in those cases of great technical difficulty, characterized by extensive adhesions, it is safer to make an end-to-side anastomosis in front of the colon adding to this an entero-anastomosis between the loops of jejunum (Fig. 8). Our post-operative observations in these cases demonstrate that the results of this operation are just as satisfactory as those that follow a posterior end-to-side anastomosis, and the anterior anastomosis will at times obviate very difficult situations. It is of first importance in the post-operative care of these cases to maintain the gastro-intestinal tract as near absolute rest as possible for four or five days following the operation and particular attention being directed to the control of retention by lavage.

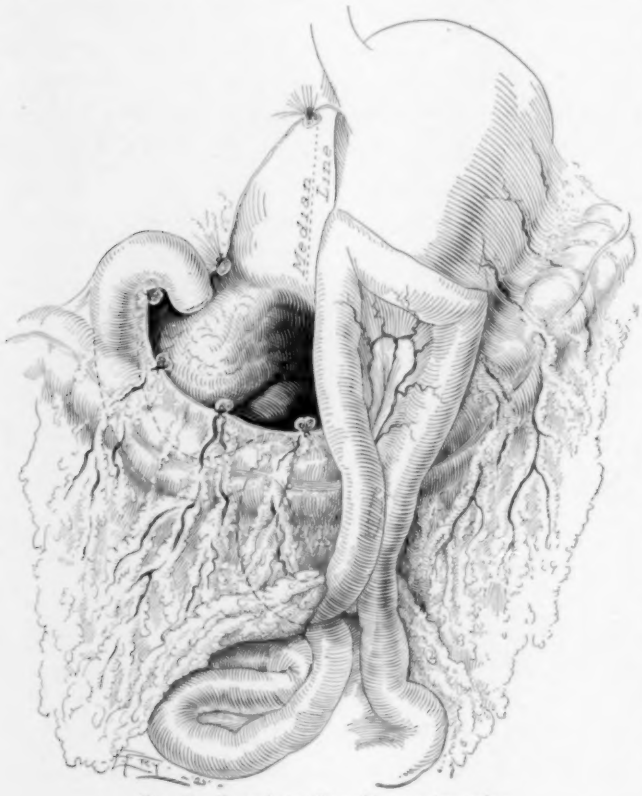

FIG. 8.—Anterior end-to-side anastomosis.

I have recently modified the procedure just described by mobilizing the anastomosis and the jejunal loop above the opening in the mesocolon, beginning the resection at the pyloric end of the stomach before the anastomosis is disconnected and carrying the division of the gastrocolic and gastrohepatic omenta above the anastomosis. This method provides a very excellent exposure of the entire anastomosis, and the excision of the anastomotic ring and the lesion can be carried out with very great precision.

In cases of complicated gastrojejunal ulcer the management of gastrojejunocolic fistula presents the greatest difficulties, and since this complication adds materially to the risk of the operation, every precaution must be taken

to carry these patients through safely. The operative procedure is the same except that the colon is first separated from the anastomosis, and the fistulous opening in the colon closed and carefully covered with surrounding omental tissues. The greatest possible care must be taken to avoid contamination and to attain secure closure of the opening in the colon. In some cases in which the fistulous opening is large or has been closed with difficulty a catheter may be advisedly sutured into the cæcum.

Acute perforation of a gastrojejunal ulcer occasionally occurs. I recently operated on a patient in whom acute perforation had taken place while he was in the hospital waiting for operation. Operation was carried out two and a half hours after the lesion had perforated, and the opening in the anterior aspect of the anastomosis was found to be about 1 cm. in diameter. There was an extensive irritative peritonitis and already much plastic lymph on the adjacent tissues. It appeared radical under such circumstances, to carry out the operation of choice in this case, namely partial gastrectomy, but it seemed reasonable to do so since the perforation was so recent. The anastomosis was disconnected; the indurated area, which extended well into the jejunum, excised, and partial gastrectomy performed. The patient ultimately recovered satisfactorily.

Bleeding occurs as a complication in gastrojejunal ulcer with greater frequency than it does in primary ulcer. It constitutes no special indications since the removal of the ulcer is practically always a part of the operation.

Chronic perforation may occur into the abdominal wall. I recently encountered a very interesting case which illustrates the very marked tendency of gastrojejunal ulcer to penetrate into adjacent tissues. Three operations had been performed elsewhere in 1915: anterior gastro-enterostomy was the first, but the others were not definitely determined. When the patient came to the clinic in 1923 there was a gastrojejunal ulcer in the anterior aspect of the anastomosis which had perforated into the abdominal wall. The ulcer was excised at this time and a plastic operation performed on the gastro-enteric anastomosis. The patient's relief from symptoms was of very short duration, and he returned in 1926 with evidences of recurring ulcer and extensive induration of the abdominal wall. Exploration revealed a perforation into the abdominal wall with a pocket 3 cm. in depth and 4 cm. in diameter. The portion of the abdominal wall, containing the base of the ulcer, was excised, the anastomosis separated, and a partial gastrectomy performed. Since the last operation the symptoms have been completely relieved.

The symptomatic results following partial gastrectomy for gastrojejunal ulcer fully justify adhering to the principle that this operation is necessary in those cases which do not permit the conservative practice of disconnecting the anastomosis only. Complete relief of symptoms follows the operation in more than 85 per cent. of the cases, and the safety of the operation is shown in the mortality rate of 3.37 per cent.

I have intended to emphasize in this paper three points: (1) that the incidence of gastrojejunal ulcer following properly performed gastro-enterostomy in well selected cases is 2 per cent.; (2) that when such recurring ulceration has developed, secondary operation should be carried out without delay, and (3) that the operation of choice, provided the ulcer in the duodenum is completely healed and no obstruction has resulted, is the disconnection of the anastomosis; and if this is not advisable, partial gastrectomy promises the best prospect of cure, and any other procedures must be looked on as ineffective substitutes.

SHORT MESOCOLON AS A COMPLICATION OF GASTRIC SURGERY*

By Frank S. Mathews, M.D.
of New York, N. Y.

The purpose of this paper is to call attention to a short transverse mesocolon. This condition is occasionally encountered in persons in whom gastro-enterostomy is indicated. It then complicates the situation because the typical posterior no-loop method of gastro-enterostomy is difficult or impossible. Surgeons must have encountered the condition from time to time, but seem not to have considered it of enough importance to call for comment. Four cases of short transverse mesocolon are here recorded which developed in the course of gastric surgery and attention will be called to the modifications of operation which have been necessitated thereby.

The first patient was a female with a duodenal ulcer and cholecystitis. On raising the omentum to expose the transverse mesocolon, a large area of the posterior wall of the stomach was encountered instead of the expected transverse colon. An investigation then revealed that the caput coli did not descend quite to the level of the umbilicus. It was fairly free, however, and the ileum was found to enter it on its left side. The condition then was one of congenital partial rotation of the colon, the rotation on its long axis being complete as shown by the entrance of the ileum from the left; but the descent of the caput into the right iliac region was arrested. In this case, posterior gastro-enterostomy was done behind the omentum, but in front of the colon. As a loop was employed, it was thought wise to add an entero-anastomosis with a Murphy button. This case was encountered ten years ago and three others have been met in the interval up to the present time.

The second patient was a man, aged forty-four, with a benign pyloric stenosis. The greater curvature of a greatly dilated stomach descended into the true pelvis. The mesocolon was found so short that a retro-colic gastro-enterostomy would have been impossible. An anterior one with added entero-enterostomy was resorted to as being the best method of handling the condition. In this patient, even had the mesocolon been of the usual dimensions a posterior, no-loop gastro-enterostomy would not have been a wise operative procedure because of the large size and extreme ptosis of the stomach. In such cases, the no-loop operation would leave the big stomach suspended from the point of anastomosis.

The third patient, a man aged forty, had two ulcers—an active one on the lesser curvature some distance from the pylorus, and a partially healed, constricting duodenal ulcer which was responsible for a considerable gastric residue. The ulcer in the stomach was excised and its bed closed by sutures. The mesocolon then being found too short to permit the posterior operation, a posterior gastro-enterostomy was performed in front of the colon. A long enough loop of jejunum was used so that there could be no possibility of its being compressed, and an entero-enterostomy was added.

In these cases then, the procedure has been either anterior or posterior gastro-enterostomy using a considerable loop of jejunum above the anastomosis and in each case, an entero-anastomosis was added to avoid the pos-

* Read before the American Surgical Association, May 24, 1926.

sibility of retention of intestinal contents in the segment of bowel above the gastro-enterostomy.

The fourth patient was a physician, aged thirty-four, with an active penetrating ulcer on the anterior wall of the duodenum. The ulcer was destroyed by a cautery and the defect closed by a layer of sutures. The narrowing of the pylorus seemed to make a gastro-enterostomy advisable. On delivering the omentum, the whole of the back of the stomach came into view covered only by one leaf of the omentum. Investigation showed the ascending colon in normal position. The transverse colon, however, lay closely applied to the vertebral column and quite fixed. In this case, an anterior colic posterior gastro-enterostomy was performed, but an entero-enterostomy was not added, though the operation was not a no-loop one. The spot employed for anastomosis was about six inches from the duodeno-jejunal junction, the gut being applied obliquely to the posterior stomach wall. In this case, the jejunum seemed to lie quite straight at the point of anastomosis and not to be angulated on either side of it. After operation the patient made a conspicuously good recovery, but I was worried for a number of days thereafter because of the omission of the entero-anastomosis. After operation, the X-ray plates in this case were reviewed and found to give some evidence of the short mesocolon. The plates taken with the patient in a horizontal position after a bismuth enema showed the transverse colon lying rather high and straighter than one would expect. Plates taken after the bismuth meal with the patient standing showed a moderately ptosed stomach. The colon, which was moderately outlined in gas, lay above the lesser curvature of the stomach instead of looping downward below the greater curvature of the stomach as one might expect.

Each of these patients has done well following operation. There has been no suggestion of vicious circle in any of the four and the patient in whom no entero-anastomosis was made has done quite as well as the others. Nevertheless, I feel that the entero-anastomosis is an added security when a long loop has to be used. When one encounters a case of very short transverse mesocolon, it will probably not be discovered until the work on the stomach has been completed. Then when the omentum is lifted up with the expectation of drawing the transverse colon immediately into the wound, one sees instead the large expanse of the posterior wall of the stomach covered only by a single leaf of the omentum. Posterior or anterior operation can easily be done. The posterior one would seem to be more desirable, especially if the omentum is of considerable size. But whether posterior or anterior operation is employed, a short loop of small bowel would seem undesirable because of the possibility of its being compressed by the descending colon. The question of whether the entero-anastomosis should be added may seem a debatable one. We have always added it in carcinoma cases where an anterior gastro-enterostomy had to be made high on the stomach wall. The entero-anastomosis, whether by suture or Murphy button adds very little to the length of operation and may be the means of sparing the patient a second operation.

In one of the above cases a short transverse mesocolon was associated with a partial rotation of the colon. In the others no associated anatomical abnormalities were encountered.

A STUDY OF THE MORTALITY IN APPENDICITIS*

By Le Grand Guerry, M.D.
of Columbia, S.C.

The present study is based on a consecutive unselected series of 2959 cases with 16 deaths or a mortality over all of 0.54. It will be worth our while if we can find the real meaning of these figures.

I do not think that I have attended a surgical meeting in ten years in which the question of appendicitis has been discussed, nor have I attended a surgical meeting in ten years in which the question of gastric and duodenal ulcer has not been discussed.

The following are five reasons, I believe, that justify my presenting to the American Surgical Association a paper concerned with the mortality in appendicitis:

1. Appendicitis is still by far the most important acute abdominal disease that surgeons are called upon to treat.

2. During the year 1925, in the United States and Canada, there probably were about 500,000 cases of appendicitis. This figure, of course, is an approximation, it is not literally true; it is not necessary that it should be literally true.

3. During the same year and in the same area there were approximately 25,000 deaths from appendicitis.

4. The death rate from appendicitis equals the combined death rate from ectopic pregnancy, pyosalpinx, gall-stones, pancreas, spleen and the thyroid gland. It nearly equals the mortality from gastric and duodenal ulcer, intestinal obstruction and gall-stones.

5. From a study of the figures available at the Government Bureau of Vital Statistics, it is clearly obvious that the death rate has increased from 11 per 100,000 of the population in 1920 to 14.4 per 100,000 of the population in 1925. This indicates a gradual rise of over 30 per cent.

The study that we are making does not represent the composite work of some group or clinic, but has solely to do with my individual work throughout the past twenty-five years.

So much then for the background on which this study is based. We will ask you to consider the study as found in group 1.

	No. cases	No. deaths	Mortality
Chronic appendicitis	1241	0	0.0
Acute appendicitis	688	1	0.15
Gangrenous, ruptured, localized abscess	570	4	0.7
Acute diffuse peritonitis	85	7	8.2
	2584	12	
Cases in extremis, abscess drained, appendix not removed	9	3	33.33
	2593	15	0.58

* Read before the American Surgical Association, May 25, 1926.

(*a*) We find that there are 1241 cases of chronic appendicitis operated on with no deaths. Someone has said of this group of cases that there were only two kinds of appendicitis: acute appendicitis and appendicitis for revenue only. In my opinion, this statement contains more of wit than of wisdom. If there is such a diseased entity as an acute inflammatory process in the appendix, then there must be such a condition in which the acute process has become chronic, else, how would you classify that large group of cases that have had a definite inflammatory outbreak, the acute attack subsides but the patient never completely recovers until the so-called interval operation is done, demonstrating an appendix that shows all of the earmarks of an inflammatory process that was once acute but is now more or less chronic. It seems to me just as logical to find a chronic inflammatory process in the appendix as it is to find it in the gall-bladder, pancreas or elsewhere. Call it by whatever name you will, all of you know precisely what I am talking about.

Of course, we do not expect mortality in this group of cases. When mortality does occur, it is the mortality of some unforseen and unforseeable calamity.

In a series of cases of this number some of them will be found to tax one's surgical skill greatly. In the average case the operation is extremely simple; in large stout people with the appendix deeply placed and inaccessible, the story may be quite different.

(*b*) Consider the acute cases. By the word acute we mean exactly what the term implies. Only the cases are here included that showed definite, unmistakable evidence of an acute inflammatory disease.

In this group is included every acute case up to the point of rupture. When the appendix was ruptured, the case was included in the group of localized appendiceal abscess or in the group of acute diffuse peritonitis. In most cases of the acute group there were gangrenous patches varying in degree, present in the appendix. In this group there were 688 cases with one death; a mortality of 0.15.

(*c*) There were 570 cases of gangrenous ruptured appendices in which the inflammatory process had become clearly localized. In this group there were four deaths; a mortality of 0.7. You will readily understand that in a group of localized appendix abscess cases of this number one would very nearly run the gamut of intraperitoneal suppuration. The abscess cavity would vary in size from that of a hickory nut to one that would extend from the cul-de-sac of Douglas to the kidney fossa and above, reaching at times into the left lower quadrant of the abdomen, I was quite surprised to find that in this group of cases there were only four deaths.

(*d*) There were 85 cases of acute diffuse peritonitis seen for the first time in this stage of the disease in which the operation was done immediately that the diagnosis was made. There were seven deaths in the 85 cases, or a mortality of 8.2. Later on we will have more to say about the management of the cases in this group, for on their management hinges in large part, the question of the mortality rate.

(*e*) This is a small group of nine cases in which the patients were in extremis from long-continued suppuration. They have been separated for the reason that they were the only cases in the suppurative group in which the appendix was not removed, and drainage was instituted under local anæsthesia. One of the points of interest in this small group is whether or not there was any relationship between the death rate of three deaths in the nine cases and the fact that the appendix was not removed.

It is significant that these nine cases are the only ones in the entire series in which the appendix was not removed.

We have then a total from the first grouping of 2593 cases with 15 deaths, or a mortality of a bit over ½ of 1 per cent.

Next we will consider group 2.

	No. cases	No. deaths	Mortality
Acute appendicitis	688	1	
Gangrenous, ruptured, localized abscess	570	4	
Acute diffuse peritonitis	85	7	
	1343	12	0.8
Cases in extremis, abscess drained, appendix not removed	9	3	
	1352	15	1.1

The principal point in this group is that the so-called chronic or interval cases have been omitted from consideration.

We find that there were 688 acute cases with one death; 570 gangrenous ruptured appendices with localized abscess, with four deaths; 85 cases of diffuse peritonitis with seven deaths; or a total of 1343 cases, exclusive of the chronic group, with 12 deaths, or a mortality of 8/10 of 1 per cent. To the 1343 cases we add the small group of nine cases with three deaths, making a total for this entire group of 1352 cases with 15 deaths, or a mortality of 1.1.

We will now consider group 3 in a study of the mortality rate.

	No. cases	No. deaths	Mortality
Gangrenous, ruptured, localized abscess	570	4	
Acute diffuse peritonitis	85	7	
	655	11	1.7
Cases in extremis, abscess drained, appendix not removed	9	3	
	664	14	2.1

You will see at once that both the chronic and the acute cases have been eliminated from consideration. This leaves for our study only the cases complicated by the gross appearance of pus.

We have 570 gangrenous, ruptured appendices with abscess, with four deaths; 85 acute diffuse peritonitis cases with seven deaths; making a total of 655 cases with 11 deaths, or a mortality of 1.7. Adding the small group of nine cases that were in extremis, makes a total of 664 cases with 14 deaths, or a mortality of 2.1. A study of the fourth group is as follows:

	No. cases	No. deaths	Mortality
Gangrenous, ruptured, localized abscess ..	570	4	0.7
Acute diffuse peritonitis	85	7	8.2
Acute diffuse peritonitis, deferred operation.	123	2	1.6

There is one series of cases in this grouping to which especial attention is directed and the group is presented with that purpose in view. I refer to the series of 123 cases of acute diffuse peritonitis in which operation was deferred. My view is that on the handling of these cases the question of the mortality rate largely rests. The whole question of mortality naturally hinges on the cases seen for the first time on the third or fourth day of the attack, cases with acute spreading infection. It must surely have been genuine insight on the part of Ochsner, who laid bare the principle that one of the chief factors in the dissemination of the peritoneal infection was the vermicular movement of the small intestine. Since in acute appendicitis with peritonitis, there is a constant regurgitation of the contents of the small intestine into the stomach, due to the closure of the inflamed ileocæcal valve, the practice of gastric lavage, which empties not only the stomach, but the small intestine as well, has its foundation in a rational conception of the diseased process. The basic principle of this treatment is that we thereby secure a condition, approximately at least, of physiologic rest to the inflamed area, which gives Nature the chance she has been seeking to complete the localization of the infection. Let me emphasize particularly the point that none of these patients were operated on immediately; they were all treated as outlined by Ochsner. With two exceptions, all were safely operated on at a later date; and in each case a gangrenous or ruptured appendix, with pus, was demonstrated at operation.

Contrast 85 cases of acute diffuse peritonitis operated at once with seven deaths, or a mortality of 8.2, with 123 cases of acute diffuse peritonitis in which operation was deferred, with two deaths, or a mortality of 1.6. Occasionally the Ochsner method has been supplemented by simple incision and drainage under local anæsthesia, to relieve absorption from pus under tension.

These 123 cases in the statistics are included in the group of 570 localized appendiceal abscesses; likewise the two deaths which occurred previous to operation are included in the four deaths in the same series. These cases have been separated for the purpose of illustrating the difference between the mortality when the cases of acute diffuse peritonitis were operated on immediately and when operation was deferred. Finally we will consider group 5.

	No. cases	No. deaths	Mortality
Chronic appendicitis	1241	0	0
Acute appendicitis	688	1	0.15
Gangrenous, ruptured, localized abscess .	570	4	0.7
Acute diffuse peritonitis	85	7	8.2
Cases in extremis, abscess drained, appendix not removed	9	3	33.33
Appendix removed in the course of other operations	366	1	0.27
	2959	16	0.54

In this group have been added 366 cases in which the appendix was removed in the course of other operations. Many times the appendix has been removed during the course of other operations, but there have only been included in these 366 cases those appendices in which evidence of inflammatory disease was unmistakable.

The group has this bearing on our study; it shows to what extent the removal of the appendix during the course of other operations increases the surgical risk. This group is a résumé of the entire work; it represents not only the best, but all that I have been able to accomplish in this field of endeavor. It also shows that the mortality over all in 2959 cases is represented by 16 deaths, or a mortality of 0.54.

In 1909, at the request of the late Dr. John Munroe, of Boston, I presented a paper on appendicitis, before the American Medical Association, in which I took substantially the same position then that I am taking to-day as regards the management of the cases of acute appendicitis complicated by the presence of diffuse peritonitis. I am more firmly established to-day than ever before, in the belief that the secret of the mortality lies in the deferred operation as applicable to this particular group of cases.

We must ever keep clearly in mind that in these cases we are handling appendicitis plus the consequent peritonitis.

If the thing for which contention is made is really a principle that should underlie the management of such conditions, then there should be a broader field of application than simply in relation to this type of appendicitis. The principle of deferred operation, broadly speaking, must be applicable in greater or less degree to the whole field of emergency surgery. This principle should underlie our management of the cases of acute infections of the gall-bladder, duodenal ulcer, ectopic pregnancy, and I would go to the point of saying, in the presence of known penetrating, perforating wounds of the abdomen, it is a mistake to operate on every case immediately they are seen. Some years ago I published a paper on penetrating gunshot wounds of the abdomen in which there were reported 27 cases with a mortality of 10 per cent. I am perfectly convinced that a number of these cases were saved by deliberately taking the necessary time to improve the patients' general condition before operating.

You cannot formulate a rule that will fit all cases, when one tries to do so, one becomes mentally stalemated. The heart of the surgical problem is to grasp the principle so clearly that the method adopted will best serve the needs of the individual case.

I have tried to be frank, explicit and, without controversy, in seeking to establish a certain basic principle of surgical practice, for surely out of the morass of medical mysticism there must be in front of us somewhere, a straight path of solid ground on which we might walk safely.

THE OPERATIVE TREATMENT OF THENAR PARALYSIS*

By Henry H. M. Lyle, M.D.
of New York, N. Y.

The purpose of this paper is to call attention to certain operations which are valuable in the treatment of thenar paralysis. We assume that nerve suture has been tried or that it is impracticable.

One of the difficult problems of reconstructive surgery has been to devise

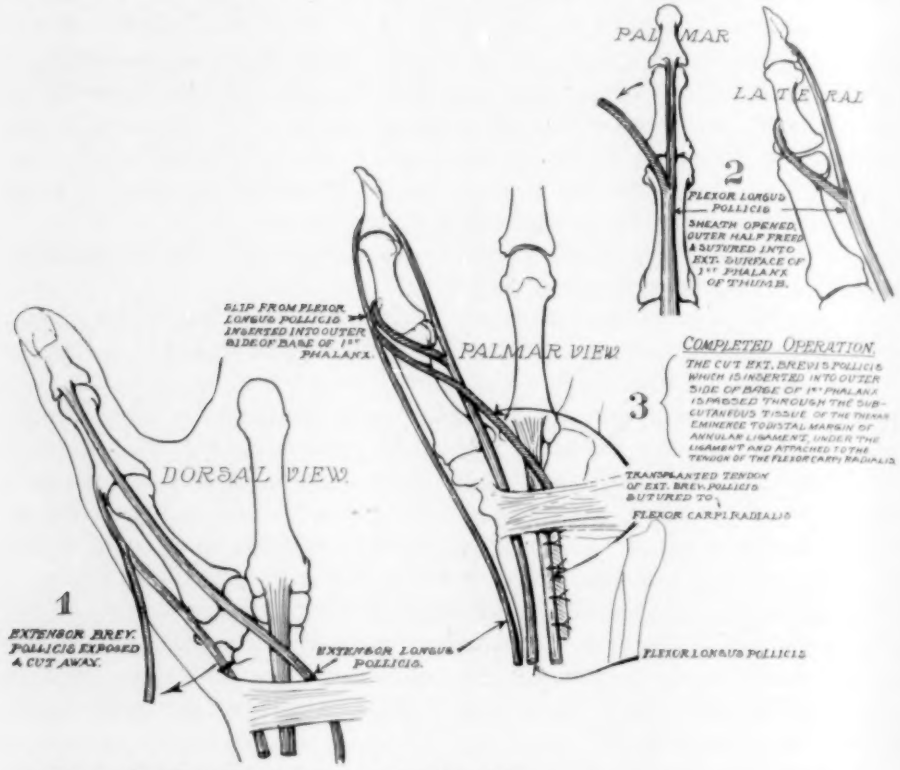
PALMAR
LATERAL
2
FLEXOR LONGUS POLLICIS
SHEATH OPENED, OUTER HALF FREED & SUTURED INTO EXT. SURFACE OF 1ST PHALANX OF THUMB.
SLIP FROM FLEXOR LONGUS POLLICIS INSERTED INTO OUTER SIDE OF BASE OF 1ST PHALANX
PALMAR VIEW
COMPLETED OPERATION
3
THE CUT EXT. BREVIS POLLICIS WHICH IS INSERTED INTO OUTER SIDE OF BASE OF 1ST PHALANX IS PASSED THROUGH THE SUBCUTANEOUS TISSUE OF THE THENAR EMINENCE TO DISTAL MARGIN OF ANNULAR LIGAMENT, UNDER THE LIGAMENT AND ATTACHED TO THE TENDON OF THE FLEXOR CARPI RADIALIS
TRANSPLANTED TENDON OF EXT. BREV. POLLICIS SUTURED TO
FLEXOR CARPI RADIALIS
DORSAL VIEW
1
EXTENSOR BREV. POLLICIS EXPOSED & CUT AWAY.
EXTENSOR LONGUS POLLICIS.
FLEXOR LONGUS POLLICIS

Fig. 1.—Extensor brevis pollicis exposed and cut away.
Fig. 2.—Flexor longus pollicis sheath opened, outer half freed and sutured into external surface of first phalanx of thumb.
Fig. 3.—Completed operation. The cut external brevis pollicis which is interted into outer side of base of first phalanx is passed through the subcutaneous tissue of the thenar emminence to distal margin of annular ligament, under the ligament and attached to the tendon of the flexor carpi radialis.

a suitable tendon transplantation to replace the intrinsic thumb muscles. The functional loss of these muscles makes the thumb useless and destroys over 75 per cent. of the efficiency of the hand. In thenar paralysis the thumb falls back into the same plane as the other fingers and cannot be opposed.

Stiles, in 1922, stated that no satisfactory tendon transplant had been devised to replace the intrinsic thumb muscles and advised an arthrodesis of

* Read before the American Surgical Association, May 24, 1926.

the first carpo-metacarpal joint. Platt and Bristow (1924) state that tendon transplants are occasionally of service in assisting function, *e.g.*, after lesions of the median nerve to restore some power in the opposing thumb, but these are not commonly practiced.

The type of operative procedure to be employed depends on the presence or absence of suitable functionating tendons. If these be present some form of tenoplasty can be used, if absent arthrodesis or fascial anchorage will be necessary.

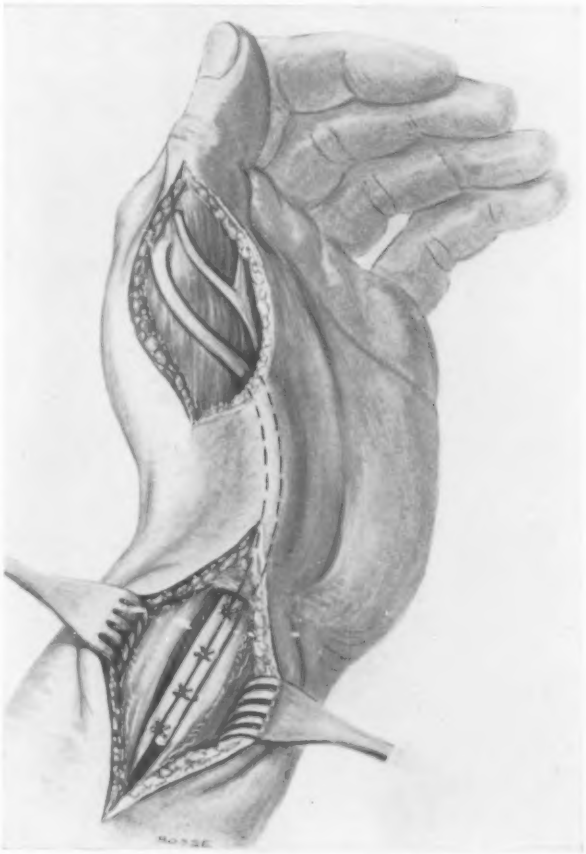

FIG. 4.—Shows the split tendon of the flexor longus pollicis, the outer limb of which has been carried subcutaneously around the outer side of the base of the first phalanx and fixed to it. The tendon of the external brevis pollicis has been carried subcutaneously across the thenar emminence, passed under the anterior annular ligament and sutured to the tendon of the flexor carpi radialis.

The pioneer in this work has been Steindler of Iowa, the other contributors being Cook, Ney and Bunnell. In Germany, Kortzeborn has devised a combined fascial transplant and plastic for "ape hand." In 1918, Steindler described his operation for the plastic substitution of the oppens action of the thumb. It is a flexor plasty of the long flexor of the thumb (Fig. 2). This operation yields an excellent functional result. Cook's operation was described by R. Taylor in 1921. It is a transplantation of the extensor mimini digiti to the distal end of the first metacarpal. The tendon is passed to the palmar surface and then through the subcutaneous tissue to be fixed into the first metacarpal. Cook has operated on four cases; in the three cases that he has been able to follow the results were very satisfactory.

Ney published his operation in 1921. It consists of a transplantation of the extensor brevis pollicis into the palmaris longus or in the absence of this muscle to the flexor carpi radialis. The operation gives a satisfactory functionating thumb. (Fig. 1.)

Bunnell, in 1924, in a case of infantile paralysis involving the extensors

of the fingers and the intrinsic muscles of the thumb, transplanted the palmaris longus into the extensor longus pollicis. The tendon of the palmaris was passed through a pulley at the pisiform bone and then through the subcutaneous tissue to the long extensor tendon of the thumb. The pulley was made out of a free tendon graft obtained from the extensor tendon of the toe. This gives an oblique pull somewhat similar to Cook's operation and like it a good power of opposition.

In those cases where the thumb assumes the flexed position when opposed

FIG. 5.—Before operation. Paralysis of the intrinsic muscles of the hand. Duration thirteen years. Note the thenar and hypothenar atrophy, absence of thenar crease, flat palm and the position of the thumb which lies in the same plane as the other fingers. Compare with normal hand.

to the fingers from lack of power of extension, the tendon which is to give the opposition to the thumb can be attached to the tendon of the tendon extensor longus pollicis at the metacarpo-phalangeal joint. The thumb will then properly oppose the finger.

The writer has employed both Steindler's and Ney's operations and obtained very satisfactory results.

The resulting pincer action of the thumb, though strong enough for ordinary use is not quite powerful enough in some cases. In an effort to improve this essential action we have tried to combine the advantage of Steindler's flexor plasty with the good points of Ney's operation.

FIG. 6.—Result after operation. Note the power of adduction and presence of the thenar crease. Patient now follows his trade.

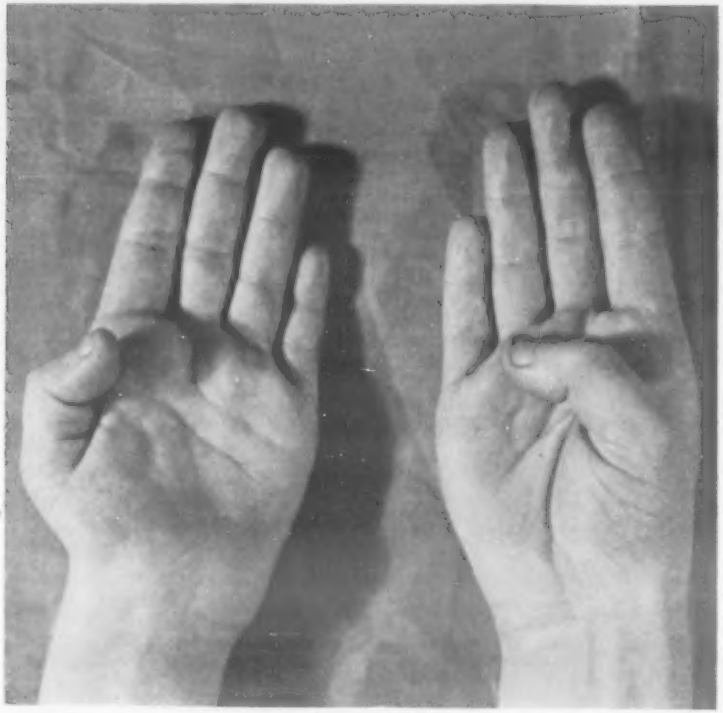

FIG. 7.—Thenar paralysis of eight years standing. Trauma to brachial plexus. Note thenar and hypothenar atrophy, the absence of the thenar crease. The palmar surface of the thumb does not face the palm directly but looks obliquely across. Any adduction is brought about by the flexor longus pollicis.

The operation consist of two steps—1. The extensor-flexor plasty (Ney); 2. The flexor plasty (Steindler) (Figs. 3, 4, 5, 6, 7 and 8).

FIG. 8.—Result after operation. Note the adduction, the formation of the thenar creases and the restoration of the palmar hollow.

1. An incision is made over the extensor brevis pollicis extending from its insertion to a point where this tendon emerges from the posterior annular ligament, the tendon of the extensor brevis pollicis is then divided at this level. An anterior incision exposing the flexor carpii radialis at the wrist is made, the subcutaneous tissue is tunneled obliquely from the distal edge of the anterior annular ligament to the insertion of the extensor brevis pollicis and the cut end of the extensor brevis pollicis threaded through this tunnel, passed under the annular ligament and sutured to the tendon of the flexor carpii radialis above the annular ligament. The palmaris longus, if present and sufficiently developed can be employed instead of the flexor carpii radialis. (Figs. 1 and 4.)

2. Flexor plasty. A palmar lateral incision is made over the tendon sheath of the flexor longus pollicis, exposing it from its insertion to a point just below the head of the first metacarpal. The tendon sheath is opened and the tendon split longitudinally; the outer half is freed from its insertion and withdrawn from the sheath, the sheath is then

FIG. 9.—Before operation. Paralysis of the intrinsic muscles of the left hand due to injury of brachial plexus. Note flat hand, thenar and hypothenar atrophy. Thumb cannot be adducted.

closed over the internal half. The external half is carried subcutaneously around the outer side of the base of the first phalanx and sutured. This can

be readily done as the previously performed incision for the exposure of the insertion of the extensor brevis pollicis gives an excellent exposure for the flexor anchorage. The thumb is then placed in the functionating position and fixed in plaster. Gentle active movement is begun on the twelfth day; all support removed on the twenty-first day. (Figs. 2 and 4.)

The author reserves his operation for the cases in which it is essential to have a powerful pincer action. In the ordinary case he employs the simpler methods of Steindler or Ney.

FIG. 10.—After operation. Functional result eight weeks after an arthrodesis of the first metacarpo-phalangeal joint.

One of our patients, a skilled wood carver and turner, sustained an injury thirteen years previously which left him with a thenar paralysis. This forced him to give up his trade as he could neither grasp nor guide his tools. Six months after the above operation the patient resumed his trade and has followed it for two years.

FIG. 11.—After operation. Functional result eight weeks after an arthrodesis of the first metacarpo-phalangeal joint.

Operative Procedures when no Suitable Tendons are Available.—1. Baldwin's operation for flat abducted thumb deformity is an arthrodesis at the basal thumb-joint, to procure a short fibrous union in the functionating position. The pincer action of thumb is now made possible and this action is valuable in performing the delicate movements, but unfortunately, the grip of the thumb is not restored. In 1922, Stiles advocated this procedure, but stated that the operation only restored the pincer action for small light objects. In our hands the function results from this operation have been inferior to those of the tendon and fascial transplants.

2. Free fascial transplants. Where no tendons are available Bunnell has

employed a free graft of fascia as a permanent check-reign. The fascia is passed from the distal end of the first metacarpal to the pisiform in such a manner as to hold the thumb in opposition. In 1924, Kortzeborn described his operation for "ape hand." He attempts to restore the hollow of the hand and fix the thumb in a functionating position of opposition.

The operation consists of a lengthening of the extensor tendons of the thumb, the fixation of the thumb in the position of opposition by a fascial transplant and a plastic on the palm.

Tenoplasty is indicated in thenar paralysis after nerve injury—where nerve suture is impossible or has failed; as an aid to hasten functional recovery in selected cases of delayed nerve suture; in suitable cases of anterior poliomyelitis and in those cases of occupational thenar paralysis which fail to respond to treatment.

Care must be taken to exclude syringomyelia, intramedullary and intradural spinal cord tumors, extra and paravertebral tumors, cervical ribs, lesions about elbow-joint giving rise to nerve pressure, tumors of the nerves, leprosy, etc.

SUMMARY

1. Thenar paralysis is a serious functional disability.

2. This disability has not received the therapeutic attention from the general surgeon that it deserves.

3. Suitable tenoplasties have been devised which yield a high per cent. of functional improvement.

4. If tenoplasty is impossible fascial anchorage or an arthrodesis will improve this otherwise hopeless condition.

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CHOLESTEATOMATOUS CYSTS*

WITH REPORT OF CASE INVOLVING THE MAXILLA

By John M. T. Finney, M.D.
and
Edward M. Hanrahan, Jr., M.D.
of Baltimore, Md.

Although cholesteatomatous cysts occur not infrequently in various parts of the body, we have recently observed one whose unusual location merits recording.

Case Report.—Female, white, sixty-four years of age, who complained of a swelling of the left side of her face. Her history was irrelevant except for the fact that all of her teeth had been extracted ten years previously. She states that this was done because of a marked grade of pyorrhœa alveolaris. Four months before our examination it had been noted that the left side of her face appeared swollen. She consulted a surgeon and a Röntgen-ray examination was made. No treatment was given, until her family physician, noting a progressive increase in size, sent her to Baltimore for an examination. At no time has she had pain or inconvenience as a result of this swelling.

Her physical examination was negative except as noted. The left side of her face was involved by a swelling located just beneath the zygomatic arch which appeared to extend below to the maxilla and upper alveolar border. The skin of the cheek was normal in appearance. The left lid-slit was slightly narrower than the right. On palpation there was felt a bony-hard, smooth, rounded tumor, about the size of an English walnut and measuring four cm. in diameter. All of the teeth had been extracted and the gingival mucous membrane was in good condition, although dental plates had been worn. The swelling extended from about the site of the upper lateral incisor to approximately the location of the second molar. It obliterated the outline of the alveolar process and was covered with normal appearing mucous membrane. It was hard and fixed, neither tender nor painful, and toward the posterior border a distinct egg-shell or ping-pong ball crepitus could be felt. The lymph-glands beneath the angle of the left jaw were definitely larger than on the right side.

A Röntgen-ray examination was made, and commented on by Dr. F. H. Baetjer, as follows: "Arising from the hard palate and projecting anteriorly there is a tumor-like growth. This growth is completely surrounded by a bony shell except at its anterior portion. This rather gives one the impression that we are dealing with a partly encapsulated tumor, semi-benign. In some respects it is more like a giant-cell than a round-like sarcoma."

At operation, in May, 1922, an incision was made over the obliterated dental line. A thin shell of bone was encountered which was easily pierced with slight pressure of the knife. Directly on opening into the cyst cavity, there was a discharge of its brownish-red viscid contents. It was noted that this material contained particles which reflected light almost like mica. The cholesteatomatous character of the cyst was immediately recognized and it was thought that the condition could best be treated by a thorough removal of the lining and the greater part of the thin bony wall. This was done and the remaining cavity packed with iodoform gauze. There was no connection found between this cyst and the immediately adjacent antrum. Healing by granulation and epithelialization took place uneventfully.

The contents of this cyst were carefully examined and were of uniform consistency,

* Read before the American Surgical Association, May 26, 1926.

consisting of inspissated material—yellowish pigment and quantities of mica-like particles. A smear of this material when seen under a microscope showed much cellular débris and typical cholesterin crystals, measuring about one to one and a half millimetres. There was neither hair nor any solid particles seen.

A section of the cyst wall showed thinned and flattened squamous epithelium, separated from the bony shell by a very thin layer of connective tissue. This thin layer contained partially or completely atrophic dermal (mucous) glands, and is to be con-

FIG. 1.—Röntgenograph of cyst occupying the alveolar border of the maxilla.

sidered as representing corium. The cyst wall, therefore, exhibits the typical structure of a dermoid cyst.

The patient was examined December 3, 1925, by Dr. Frank C. Wilson, of Birmingham, Alabama, who found a cavity in the upper jaw extending to the midline. This cavity was lined with normal mucous membrane. There was no evidence of any tumor.

The possibilities regarding the origin of this cyst interested us greatly. Whether its epithelial nature is connected with dental structures or with one

of the simpler forms of epithelial cysts, we cannot be certain. The solution of the question would be more definite were it not for the history of pyorrhœa alveolaris preceding the extraction of the teeth. This brings up the possibility of an inflammatory origin, which must be considered.

The various cysts and tumors of the maxilla are considered in most cases to have a dental origin. Malassez, in 1885, referred most of these tumors to embryonal remnants of the enamel organ. He found in the fetus many small groups of cells scattered along the roots of the teeth, which he designated "paradental epithelial débris." It is Ewing's opinion that these cell groups are derived from the invaginations of gingival epithelium which go to make up the enamel organs, and that dilatation of these vestigial structures gives rise to the various simple cysts found in contact with or in the neighborhood of the roots. These simple or multiple cysts of the maxilla containing walls or cavities and imperfect or well-formed teeth, appear in many cases to be derived from these paradental structures and from the specialized mesodermal element over which the enamel organ exerts a formative control. The sole source of the entire group of cystic and solid malignant epithelial growths arising in the maxilla is, according to Ewing, to be found in the paradental epithelium. The extent to which the dental follicle itself is concerned in the formation of these dentiferous and dentigerous cysts is uncertain. It is believed that the more complex growths arise from the original or from supernumerary dental follicles. The transitions which may occur between

FIG. 2.—Bony shell on left, with cyst wall on right. The inner lining of the cyst wall consists of a thin layer of stratified squamous-cell epithelium. The tissue between this lining and the bony shell represents corium.

simple groups of paradental epithelium and true supernumerary enamel organs will account in some measure for the variation in structure and contents of maxillary cysts.

These cysts and tumors of the maxilla may be divided into two groups, depending on their relation to the teeth. Adamantinoma and radiculo-dental cysts are considered to be related to erupted normal or carious teeth. Corono-dental and dentigerous cysts affect the tooth before its eruption, and may prevent its full development.

Adamantinoma arises from the paradental epithelial débris. It may be solid, or cystic, or both. When solid, it may be very cellular and malignant. The cells vary from simple squamous epithelium to the more specialized enameloblasts. In the solid form its appearance sometimes suggests a round or spindle-cell sarcoma, but the peripheral arrangement usually indicates its true character.

The cystic form may be single or multiple, or there may be a papillary form containing small cysts. The contents of the cyst may be serous, mucoid, inspissated fatty or caseous material. Adamantinoma usually occurs in the adult, and there may be a history of extraction of a carious tooth.

Radiculo-dental cysts are attached to the roots of normal or carious teeth and are thought to arise from the deep paradental epithelial débris, by proliferation and dilatation of these structures. The smaller cysts may suppurate and, the epithelial lining being destroyed, appear as a small abscess. Several large cysts, apparently of this origin, have been described. Bland-Sutton encountered several, and his examinations confirmed Turner's observation that they are lined by stratified epithelium and also that the contents often contained cholesterine crystals. This structure has suggested a dermoid origin. Larger cysts have also been described by Sirantoine, and Witzel believes that they arise from dilatation of von Brunn's sheath. This sheath is a continuation of enamel epithelium over the root of the tooth, and is included by Malassez with the paradental débris.

Corono-dental cysts, dentigerous cysts and odontoma usually occur in young adult life, before the full development of the teeth has been reached. Corono-dental cysts are usually small cavities, whose walls are lined with epithelium and into which project one or more deformed teeth. Dentigerous cysts and odontomas include those cysts or solid tumors caused by an increase in number of more or less well-formed teeth. The cysts occur in various forms. There may be cysts containing one or more teeth, or the teeth may be multiple and usually deformed. The odontoma is made up of aggregates of these teeth, sometimes with cysts. Localized growths of dental structure are related to odontoma. The different forms doubtless present different modes of origin. When the normal tooth is absent, its follicle is probably the source of the origin of the tumor. When normal teeth are present, abnormalities may be traced to supernumerary follicles, or the less orderly growths to the paradental epithelial débris.

This brief résumé of the cysts and tumors of dental origin is possibly necessary in order properly to evaluate the suggestion that the cyst in our case may be of dermoid origin. Epithelial cysts are usually atheromatous, implantation or traumatic dermoids, congenital epidermoids or true fissural dermoids. It is to the latter variety that this cyst may be related.

The true fissural congenital dermoid is located in those regions of the body which can be considered subject to embryonal disturbances of develop-

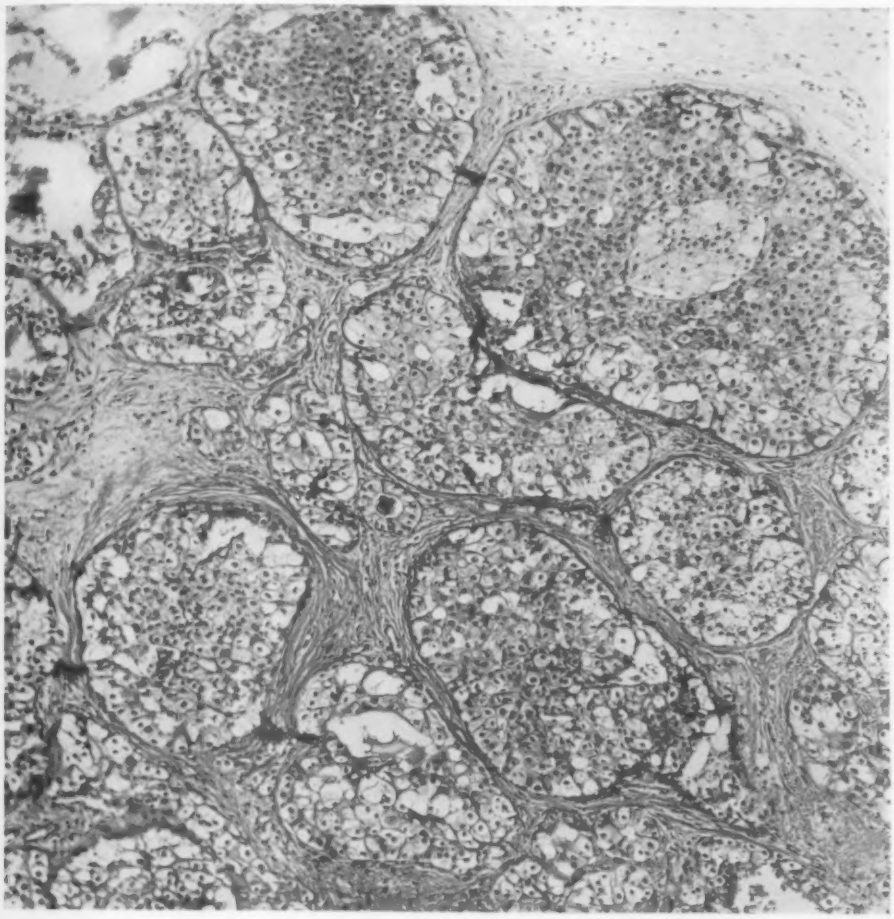

FIG. 3.—Atrophic mucous (dermal) glandular tissue found in corium of cyst wall.

ment. Their common occurrence in the scalp, neck, back, along the median line of the chest and abdomen, sacral region and buttocks is in accord with their relation to embryonal fissures, clefts and junctures. The cyst wall may present all structures of skin, including epidermis, dermis and dermal glands.

Of the more common dermoids, the intracranial variety is interesting in this connection, owing to the occurrence of the intracranial cholesteatomata. Cushing, Horrax, and Bailey have fully discussed these unusual tumors, which were called by Cruveilhier "tumeurs perlées," and by Bostroem, "piale

epidermoide." According to Ewing, the relation of the medullary groove to the ectoderm, the complex steps in the formation of the brain and ventricles, and the formation and union of the cranial bones give abundant sources for the development of epidermal growths within the skull. The interpretation of these tumors is further complicated by the occasional tendency of endothelial growths to copy the structure of cholesteatoma, and finally, traumatic implantations of portions of ectoderm account for a small proportion of

FIG. 4.—Contents of cyst, showing the crystaloid character. Giant cells are also to be seen. A smear of this material immediately after operation showed quantities of typical cholesterine crystals.

intracranial processes. Bailey found that the favorite location for these collections of epithelial cells is in the pia mater around the base of the brain. They may project upward into the cerebello-pontine angle, the fissure of Sylvius, between the frontal lobes, or into the third ventricle. They often occur extradurally under the parietal or temporal bones. Rarely, they may be found in fourth ventricle or, more frequently, in middle ear cavity. Bailey felt that no better example could be found of a tumor originating in a group of epithelial cells separated from its normal surroundings and developing autonomously.

One mechanism of this inclusion of epithelial cells is the faulty separation of skin and dura, when the membranous cranium chondrifies. The resulting epidermal rest may be outside or inside the bone, where it would project on the inner surface or between layers of dura.

The histological description by Bailey of his pearly tumors is much the same as that of our maxillary cholesteatomatous cyst. The pearly tumors are composed of a fine fibrous wall whose inner surface is covered by layers of flattened cells containing keratohyaline granules, and also masses of cells flattened and structureless, or with only the intercellular substance remaining, giving the appearance of the cells of woody plants. The interior may be a broken-down mass of débris containing fatty material and cholesterine crystals.

While the majority of cysts and cystic tumors of the maxilla undoubtedly have a dental origin, it is quite possible that epithelial cysts in this region may arise from a defect in the fusion of the premaxillary process with the maxilla proper. It will be remembered that the premaxilla has, according to Albrecht and Warinski, two centres of ossification. These centres appear about the eighth week, and by the tenth week have fused together so that the bone consists of two portions, the premaxilla and maxilla. The suture between these two sometimes persists into adult life, and may be seen as a delicate line which extends forward and laterally from the anterior palatine fossa to the interval between the lateral incisor and the canine tooth. This would correspond to the anterior border of the cyst observed in our case. It is quite possible that the inclusion of an epidermal rest at this point of fusion would furnish a genesis quite apart from any dentigerous origin, which would be entirely compatible with the fissural origin of true dermoids.

The interesting possibilities suggested by the occurrence and position of this tumor, from the standpoint of both pathology and embryology, have prompted us to take up the time of the Association with this brief report.

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CORRESPONDENCE

ANTERIOR GASTRO-JEJUNOSTOMY

EDITOR ANNALS OF SURGERY:

Sir:

There are some conditions in which I prefer, indeed am forced, to perform an anterior short circuit, for example, when the stomach is fixed by adhesions, a not infrequent complication in deep ulceration of posterior gastric wall; when the lumen of stomach is occupied by a large reactionary tumefaction, the cardia segment generally remaining uninvolved; when hour-glass contraction is met with necessitating, always, an opening in proximal portion; and when the patient's general condition demands a rapid, and comparatively bloodless, operation.

I have found that anything which interferes with the mobility of the stomach is, as a rule, a contra-indication to the posterior method since this organ cannot be drawn out sufficiently, through the meso-colic opening, to admit of its facile approximation to jejunum, and it is most essential that the anastomosis should be made at a site on the gastric wall well above the diseased area which will not curtail subsequent movement of the unaffected segment of the stomach.

It is worthy of some reflection that the number of injured blood-vessels encountered in the necessary incision on the anterior wall of the greater curvature do not, in practice, amount to one-half of those which have to be dealt with in an incision through the posterior zone of the same.

The anterior operation possesses further advantages in that it does not entail an opening through the meso-colon, and there is considerably less exposure and traction of viscera during operation with consequent less tendency to supervention of shock, not to add that an anterior gastro-enterostomy can be completed in much less time than can a posterior one.

I find that vomiting after the anterior method is not any more accentuated than after posterior gastro-enterostomy, and have proved that the more one rivets attention on not leaving any proximal jejunal loop, in either method, the less the likelihood of any serious vomiting ensuing.

Post-operative hæmatemesis is generally the result of defective surgery, and merits similar introspection as secondary hemorrhage after a radical cure of hernia.

The method which I employ in anterior gastro-jejunostomy is similar to what I have for nigh thirty years practiced and advocated in the posterior operation (*vide The Lancet*, October 26, 1912), *viz.*, primary approximation of serous coats by silk Lembert stays, frank visceral incisions, every bleeding point is seized by forceps and ligated with fine catgut, guided by insertion of other silk Lembert stays at strategic distance the serous surfaces are united

by a continuous medium silk Lembert suture, and the mucous coats by a circular medium catgut. N. B.: Meticulous avoidance of inclusion of the mucosa in any silk point of suture is, in my experience, a guarantee against a subsequent peptic ulcer.

In both methods I endeavor that, when the operation is concluded, the portion of jejunum proximal to the anastomosis will lie snugly without drag and without loop horizontal to stomach, and that the distal jejunum, with due peristaltic distention, will without semblance of pucker or kink hang vertically downwards like a nice fitting dress, a pleasing cosmetic vista which on retreat leaves the happy reflection that "the wind is fair for Sparta"—and seldom does this omen fail to prove correct.

I have seen some truly astounding disappearance of gastric "tumors" follow gastro-enterostomy, an operation which in combination with subsequent rest in bed for one month, and strict milk glucose (plus a little alcohol) diet for thirty days, followed by another month of soft nutritious food, and one year of subsequent careful feeding, cures a gastric or duodenal ulcer.

JOHN O'CONOR, M.D.,
Buenos Aires, Argentine.

CONTROLLING BLEEDING FROM THE CYSTIC ARTERY

EDITOR ANNALS OF SURGERY:

Sir:

In discussing the report of a case of biliary fistula made by Dr. Fordyce B. St. John, before the New York Surgical Society, at a stated meeting March 10, 1920, Dr. Hermann Fischer referred to a "simple method to control" bleeding from the cystic artery caused by slipped ligature or anomalous vessel. ANNALS OF SURGERY, vol. lxxxiii, p. 657, June, 1926.

The method consists in compressing the structures which run in the hepato-duodenal ligament by inserting the left index finger into the foramen of Winslow and "hooking it up." By this manœuvre he succeeded in saving a patient on the operating table.

I should like to refer you to a short article by Dr. Duncan Parham, formerly of New Orleans and now of Titusville, Pennsylvania, in which he describes in detail the same procedure (in *S. G.* and *O.*, vol. xli, p. 367, September, 1925). It had accidentally occurred to him in a demonstration on a dog in his course of operative surgery in the Medical School of Tulane University. The cystic artery was accidentally cut and he managed to find it in this way and tie it. He then deliberately cut the cystic artery a number of times and was able easily to secure the artery in every instance by the method described. He has recently told me that he had succeeded in carrying out the same procedure in a human being where he had failed to secure an anomalous cystic artery before cutting the pedicle of the gall-bladder. The bleeding was profuse and the whole field was obscured, but he was able to control the bleeding by the method and without difficulty secured the vessel.

We looked up the matter at the time in the accessible literature, but failed to find any mention of it, as Doctor Fischer also stated.

Doctor Bunts, of the Cleveland Clinic, mentions in an article on the gall-bladder in *International Clinics* (vol. iv, series 35) a case reported to him by a surgeon in which he had cut through the friable walls of the artery when tying it and it was with the greatest difficulty and after an alarming loss of blood that he was fortunately able to arrest the hemorrhage.

I believe this little expedient would have saved the surgeon much embarrassment.

I have thought the matter of sufficient consequence to call it to your attention.

Yours very truly,

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